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Operating Features of Automatic Switching Equipment

Smaller Stations Practical and Economical When Provided With Automatic Control—Protection Provided Against Abnormal Conditions and Abuse—Advantages Found in Hydroelectric Plants

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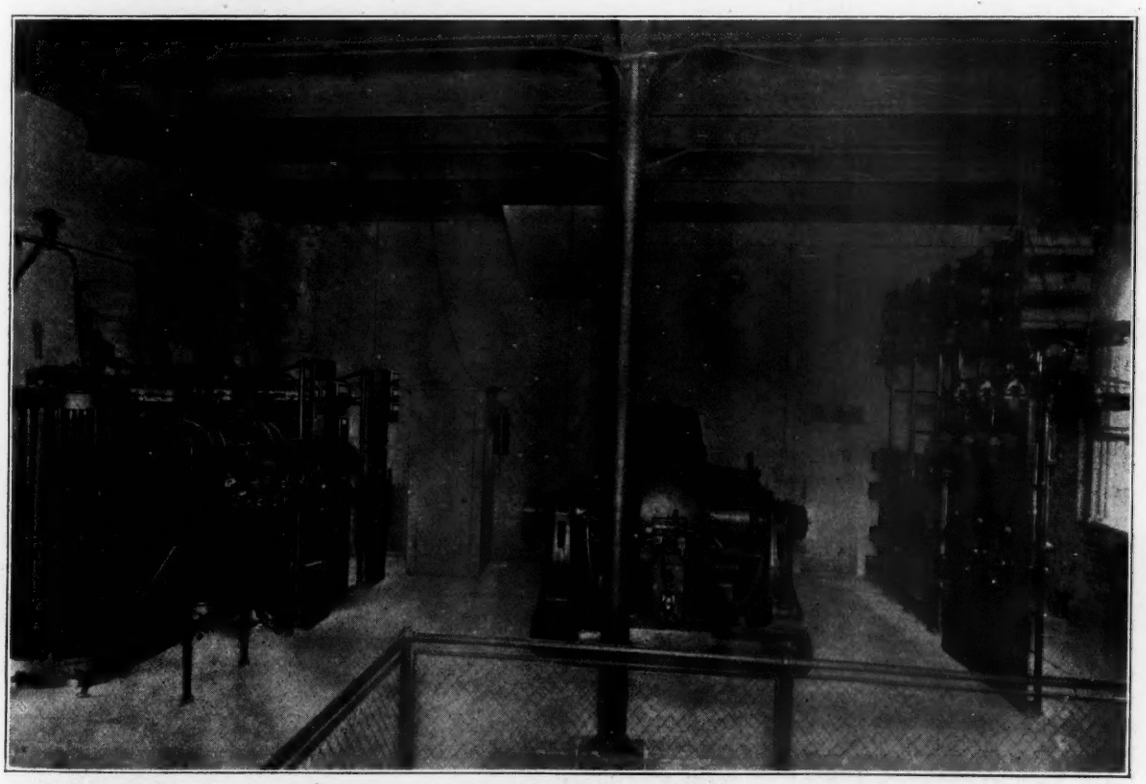
Automatic switching equipments present a new economic situation to companies operating all sorts of public utilities. They present a marked development in the art, and permit the placing of converting and transforming stations at load centers instead of forcing their grouping in unnatural locations on account of operating costs. They allow hydroelectric developments to be made with a minimum expenditure for water sites. These equipments have been developed to meet a wide variety of conditions and have proved their reliability and economy on many large and important systems.

A decade ago the Detroit Edison Co. found the load increasing on some of their 250-volt, 3-wire d-c. mains, and additional converting capacity was required at certain points, although not of sufficient magnitude to warrant the usual substation. The suggestion was made to install a suitable rotary converter at the new load center and remotely control it from the nearest substation. Early in 1911 the plans were drawn for a 500-kw. remotely controlled rotary converter substation located at Rowena street, about a mile from the nearest attended substation. It was controlled through the 3-phase circuit which supplied the



First Completely Automatic Station, Placed in Service Dec. 25, 1914.

Automatic Rotary Converter Substation of 1000-Kv-a. Capacity.

power for operation. It was placed in operation in 1912 and has been operating successfully ever since. It was later followed by three similar equipments which are also in successful operation.

The success of the attendantless remote-controlled substation led to the development of the completely automatic substation. This was first projected for the Ft. Dodge, Des Moines & Southern railroad. The first equipment, however, was actually started Dec. 25, 1914, at Union, Ill., on the Elgin and Belvidere Electric railroad. Since that time over 75,000 kw. of transforming and converting apparatus has been made completely automatic and is operating successfully.

The operation of manually and automatically controlled stations is strikingly similar. In fact, the automatic station merely extends the control of the present manual station to include starting, paralleling and stopping the equipment. Manual control requires an operator to start the equipment and place it in service in time to meet the demand for power supply, while automatic control responds either to a power demand or to a master element which causes the equipment to function to meet load conditions. The manually operated equipment is automatically protected after it is placed in service; the automatically controlled equipment is similarly protected. The manually operated equipment is shut down when load conditions permit; the automatically operated station functions in the same manner. The automatic equipment, however, is superior to the manual equipment because it is automatically protected against abnormal conditions during the starting and paralleling periods, as well as during the running period.

Savings Accomplished by Use of Automatic Equipment.

Saving in operating expense is an important item of automatic switching economy. Compare the expense of purchasing and operating three 1500-kw., 250/275-volt synchronous converters manually operated in a single station with the same capacity installed in three single-unit automatic stations. The manually operated station would require booster converters. The automatic station could use the less-expensive field-controlled type. The electrical equipment for three automatic stations complete would cost about $20,000 more than that for a single manually operated station. The manual station would require three shifts of two operators each. The average annual wage may be taken at $1500, which gives an annual operating charge of $9000 for the manual station. The automatic stations would have a combined operating expense of $750 per year for maintenance and inspection. To this is added a 15% investment charge on the additional cost of the automatic equipment. The equivalent operating charge of the automatic station is thus $3750 per year. This is a saving of $5250 per year in favor of the automatic station. In other words, the automatic equipments show a margin of over 26%, or $5250 per year, on a $20,000 investment.

Another example is the economy possible in railway applications. A city line is feeding a rapidly growing manufacturing district. To handle the increased service a 1000-kw., 600-volt, d-c., 13,200-volt, a-c. substation is required near the load center. An automatic station would cost approximately $10,000 more than a manual substation. The annual operation charge for a manual substation would amount to $5000, while the same charge for the automatic station would be only $400. The increased fixed charges on the additional investment at 15% would come to $1500, and the increased maintenance on the automatic equipment would be $200. Thus, while the fixed charges would be increased $1700 per year, the operating charge would be reduced $4600 per year, and the automatic equipment would pay for itself in about three years.

The savings effected by automatic equipment in small water-power plants is even more marked. On a low or moderate head 500-kw. equipment the added cost of the automatic equipment would not exceed $3000. At 15% this would be $450

Automatic Switchboard for 500-Kw. Synchronous Motor Generator.

annually. To this should be added an annual maintenance and inspection charge of $250, which makes the charge for automatic operation $700 per year. The equivalent manual station would require three or probably four operators with wages from $3600 to $5000. Hence, it is seen that the added cost of the automatic features is paid for by the saving in wages during the first year.

Protection Features Obtained by Automatic Plant Operation.

The automatic equipment provides protection against abnormal conditions at all times and prevents abuse. The manual equipment is not so

guarded, and this is an important consideration. For example, an automatic equipment cannot place a synchronous converter on the line if its polarity is wrong. The manually operated equipment permits this if the attendant is careless. Similarly, the machines cannot be connected to the line by an automatic equipment unless their terminal voltage and other details are correct. The manual equipment does not prevent this action and ofttimes permits costly damage.

The distribution losses in a system are reduced by the installation of automatic stations. Transforming or converting apparatus can be economically divided into smaller units, and each placed nearest its natural load center. Thus, the low-pressure distribution loss is minimized, while the high-pressure loss is left practically unchanged.

Feeder copper is saved by the use of automatic stations by subdividing the units and placing them at or close to the load centers. If feeder copper is installed on the basis of current-carrying capacity the per cent saving will vary directly with the size of the station. The larger the manual station supplanted by automatic stations the larger will be the saving. In one system recently made automatic enough feeder copper was taken out to more than pay for the automatic equipment.

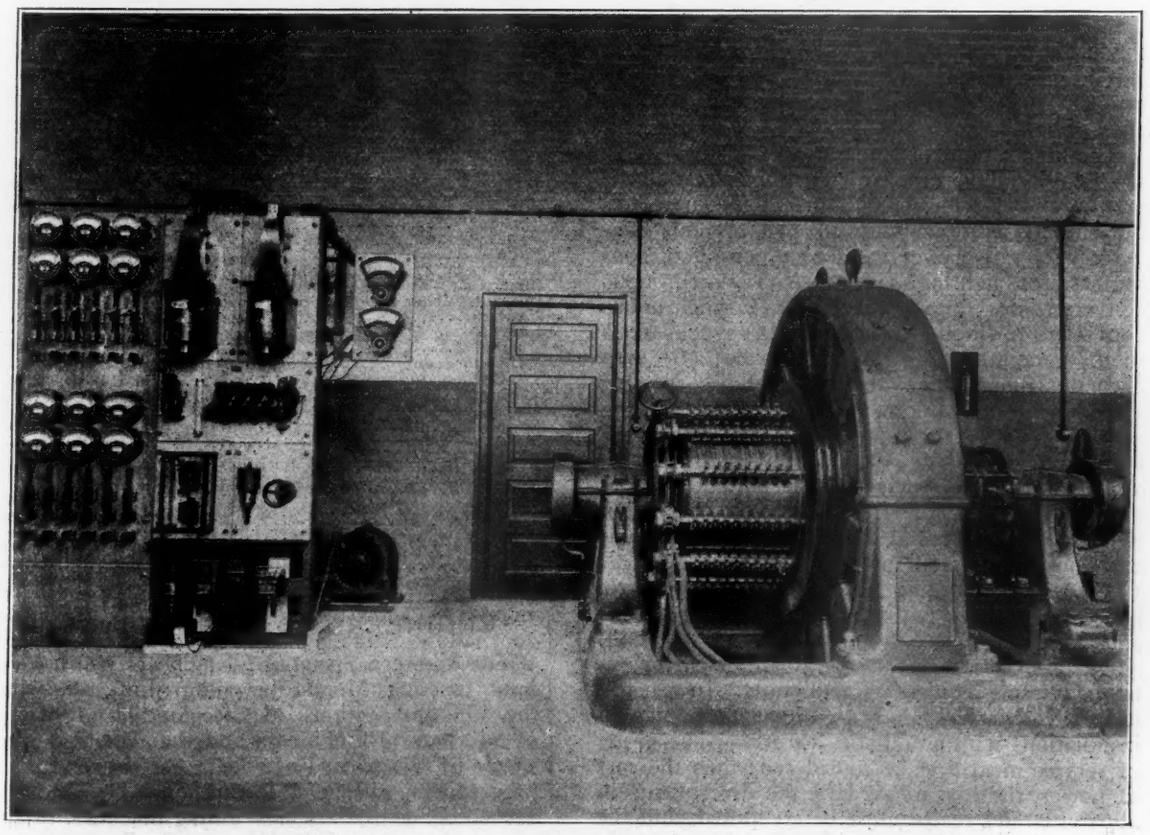
Line-Pressure Conditions Influenced by Automatic Control.

Line pressure is made more uniform by the application of automatic equipments. Transforming and converting units can be connected at a greater number of points, reducing the drop between feed points. In one large railway system

Substation with 600-Kw. Induction-Motor-Driven Generator.

this resulted in increased capacity, decreased platform expense and decreased maintenance. The capacity was increased and the platform expenses were reduced by the ability to operate longer trains. The maintenance was decreased because the schedule speed was maintained with a lower maximum speed. The railway in question cut its maximum speed over 15% and yet increased its capacity and maintained its schedule.

Light-load losses can be minimized by automatic stations. This is of importance where the cost of the electric energy is a considerable percentage of the total operating cost. The stations may be made to start when there is a demand for power, and can be arranged to shut down when the demand ceases. They will then not operate for long periods at light loads as will the manu-



First Remotely Controlled Substation Operating on Edison 3-Wire System.

ally operated stations. Their stand-by losses are thus reduced to a minimum. This saving varies, depending on the load cycle. It will be greatest on an interurban road where hourly service is the rule and it will be least in an industrial plant where the light-load losses are so small a portion of the total operating expenses as to be negligible and readiness to serve is of prime importance.

Reservoir Costs Reduced Where Water Serves as Source of Power.

Storage reservoir costs are reduced to a minimum by the automatic hydroelectric station. Present hydroelectric practice requires relatively large plants in order to minimize the operating expense. The result is a large expensive power site, dam and storage reservoir. Automatic switching equipments permit each power site to be developed individually to its economical limit, and make possible the development of vast amounts of hydroelectric power not commercially valuable under

Automatic Hydroelectric Generating Station with Three 500-Kv-a. Units.

the usual scheme. The automatic hydroelectric station needs no operators. It has solved the problem of the commercial development of power sites of small capacity.

The application of automatic switching equipment covers almost the entire field of electric generation and distribution. Some of the more important are as follows: (1) Synchronous converters for railway service; (2) synchronous converters for lighting service; (3) synchronous converters for mining service; (4) synchronous converters for industrial service; (5) synchronous motor generators for railway service; (6) synchronous motor generators for lighting service; (7) synchronous motor generators for mining service; (8) synchronous motor generators for industrial service; (9) induction motor generators for railway service; (10) induction motor generators for mining service; (11) induction motor generators for industrial service; (12) synchronous motor generators for lighting service; (13) battery-charging sets; (14) hydroelectric generators, and (15) alternating-current feeder substations.

The application of automatic equipment to existing systems requires careful study. In general, it is not advisable merely to augment the manual installations with automatic features. The grade of service must first be considered; then the cost of power, the cost of feeders, the investments in apparatus and realty must be computed, and the interest charges allocated. Finally, the saving in operating charges must be reckoned. On systems having substations interconnected on the d-c. side much of the saving is effected by a more economical location of the apparatus.

Automatic switching equipment represents the application to converting and transforming apparatus of the principles which have proved successful in many other fields of electrical applications. The devices which have been found reliable in manually operated equipments have been grouped in such fashion that they automatically perform all of the functions of starting, paralleling, loading, protecting and shutting down all kinds of converting and transforming equipments and some kinds of generating equipments. The principal features of automatic stations may be summarized as follows: (1) Better protection is provided at all times; (2) maintenance costs are reduced; (3) distribution pressure is improved; (4) feeder loss is decreased; (5) standby loss is decreased; (6) reliability is increased; (7) development of small power sites is made profitable; (8) power-factor can be kept high, and (9) minimum operating personnel is required.

INCREASE IN ELECTRICAL EXPORTS FOR APRIL.

Total Amounts to $9,085,598; Increase of $2,131,248 Compared With Same Month Last Year—Ten Months' Figures Are $103,065,899.

The exports of electrical goods to foreign countries for April were valued at $9,085,598, compared with $6,954,350 for the corresponding month in 1920, or an increase of $2,131,248. For the 10 mo. ending April, 1921, the total exports amounted to $103,065,899, an increase of $33,821,712 over the 1920 figures and an increase of $41,061,924 over the total for the 10 mo. ending April, 1919.

The following classified figures give the detailed data for April, 1921, compared with the corresponding month for the previous year:

Electrical machinery and appliances (except locomotives):	April, 1920.	April, 1921.
Batteries	$ 487,472	$ 430,235
Carbons	84,967	12,059
Dynamos and generators	636,362	569,941
Fans	149,728	120,361
Heating and cooking apparatus	140,715	165,962
Insulated wire and cables	526,556	807,218
Interior wiring supplies, including fixtures	308,091	170,038
Lamps—		
Arc	698	1,927
Incandescent—		
Carbon filament	11,514	22,602
Metal filament	352,669	384,224
Magnetos, spark plugs, etc	310,744	131,474
Meters and measuring instruments	181,663	250,913
Motors	923,096	1,711,620
Rheostats and controllers	66,389	164,745
Switches and accessories	272,680	432,487
Telegraph apparatus, including wireless	44,394	42,590
Telephones	326,497	447,530
Transformers	169,976	783,906
All other	1,960,139	2,435,766
Total electrical machinery, etc.	$6,954,350	$9,085,598

ENGINEERS TO MEET JOINTLY.

The Western Society of Engineers will hold a joint meeting Monday evening, June 20, with the Chicago sections of the American Society of Mechanical Engineers and the American Institute of Electrical Engineers. A feature of the proceedings will be a lecture on "The Motion Picture's Secret Part in Winning the War." The electrical section of the Western Society of Engineers will also elect officers at this meeting.

Recording of Ash-Pit Loss From Chain-Grate Stokers

Thermometer Records Heat Wasted as Unburned Coke—Continuous Chart of Ash-Pit Loss Permits Determination of Stoker Performance Curves—Paper Before Convention of A. S. M. E.

By E. G. BAILEY
President, Bailey Meter Co., Cleveland, O.

There has been more guesswork and less knowledge regarding ash-pit loss than any other thing of equal importance in the boiler plant. It pays to watch the ash pile from every kind of stoker or hand-fired furnace, though it be only visual inspection, to note whether it is well burned out or full of combustible. To sample and analyze the ashes regularly and calculate the heat lost in that manner is better still, yet it is done in comparatively few plants. Even the sampling and analysis of the ashes fall far short of accomplishing the desired result. A sample taken from the entire plant each day leaves the responsibility divided between the different firemen and different types of stokers. To take a sample from each boiler for each shift would still not accomplish as good results as if the ash-pit loss were continuously recorded for each boiler.

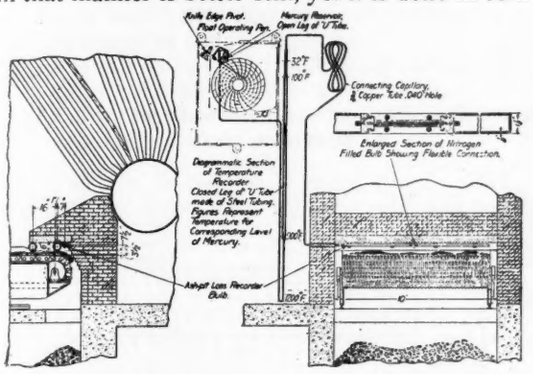

Knife Edge Pivot
Pivot Operating Pin
Mercury Reservoir
Open Leg of U Tube
Connecting Capillary & Copper Tee, .040 Hole
Enlarged Section of Nitrogen Filled Bulb Showing Flexible Connection
Diagrammatic Section of Temperature Recorder
Closed Leg of U Tube made of Steel Tubing. Figures Represent Temperature for Corresponding Level of Mercury.
Ash-pit Loss Recorder Bulb

Fig. 1.—Ash-Pit Loss Recorder With Natural Draft Chain-Grate Stoker in Station B.

Method Employed in Recording the Ash-Pit Loss.

Instantaneous readings of any kind are most valuable in aiding the fireman to obtain results. He can then see a faulty condition as soon as it takes place or even starts to take place, and can remedy it promptly. If such readings are recorded continuously the fireman can see how quickly the remedy is effective. Such records also show the executive in charge of the plant just what took place at all times. It is the purpose of this article to present some preliminary data obtained from a device recently developed to record the ash-pit loss from chain-grate stokers. It may later be extended to some other types of stokers of either the present or modified design, but the great need for it on chain grates led to it being applied to these first.

The fundamental principle used in recording the ash-pit loss by this method is to place a temperature-recorder bulb at a point near where the ashes are discharged from the active section of the grate or furnace. The bulb is not in contact with the ashes, but receives only the radiant heat from the coke being discharged. The relation between this temperature and the amount of combustible in the refuse, and the heat loss due to it, is established by taking a series of samples corresponding to different temperature readings. If the ashes are well burned out so that there are no live coals, the temperature is comparatively low. Even though the ash has clinkered rather badly and retained a certain amount of temperature, it has usually lost its glow and is comparatively cold from a radiation standpoint. The coke coming over is still ignited and at a temperature of about 1800 to 2000 deg. F., so that its radiant heat to the bulb is sufficient to cause very decided changes in the temperature readings.

In selecting a location for the temperature-recorder bulb it is necessary to have it shielded from any radiant heat of the furnace itself, and also as free as possible from changes in temperature due to the surrounding brickwork, circulation of air, etc. It is necessary that the bulb extend across the entire width of the grate and be so constructed as to obtain an accurate average in case the amount of coke coming over is greater on one portion of the grate than another. Fig. 1 shows an installation on a natural-draft chain-grate stoker with a 9-ft. bulb located just beyond the water back, which shields it from the heat of the furnace. It is located about 7 ins. above the rear end of the grate, so that the radiant heat from any coke passing under it will increase its temperature.

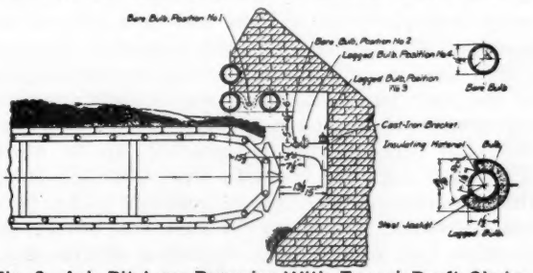


Fig. 2—Ash-Pit Loss Recorder With Forced-Draft Chain-Grate Stoker in Station A.

Temperature Recorder Must Be of Rugged Construction.

The temperature-recorder bulb itself is made very rugged to withstand this service. It is con-

structed of 1.5-in. steel tubing with ⅛-in. wall and all joints are welded. The bulb is charged with nitrogen and the gas pressure that is exerted by an increase in temperature is conducted

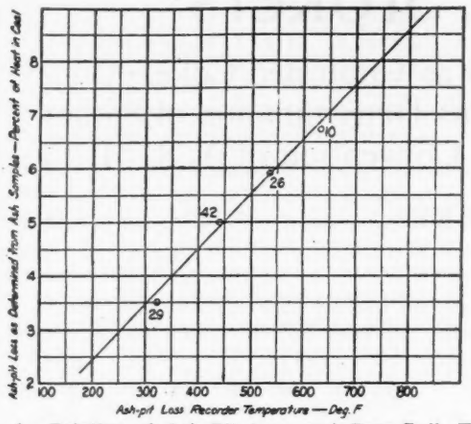


Fig. 3.—Relation of Ash-Pit Loss and Bare-Bulb Temperature From Position No. 2 in Fig. 2.

through a 3/16-in. copper capillary tube to the recorder. The recorder consists of a simple mercury U-tube, one leg of which is open to the atmosphere and carries a float to which the recorder pen is attached. The other leg of the U-tube is made up of sections having different cross-sectional areas, so that the pen movement is suppressed below and above the range to be recorded on the chart. It is also possible, if necessary, to have the area of one leg of the U-tube variable so that the percentage of heat loss will be recorded directly with uniform graduations on the chart in case the relationship between the ash-pit loss and temperature should not be a straight line.

Up to the present time the experiments have been largely confined to the selection of the best locations for the bulb with respect to the grate and also to determine the relative advantage of bare bulbs and those having lagging around a portion of their circumference so as to minimize the heat received from or given off to the surrounding walls, air, etc. Fig. 2 shows the location of a bulb at the end of a forced-draft chain-grate stoker. A bare bulb was first located at position No. 1 with cast-iron supports. It was found that when the fuel was up to the bottom of the waterback, and there was a slight positive pressure in the furnace, a flame would envelope the bulb sending the temperature up to more than 1500 deg. F. No data were obtained from this recorder in the No. 1 position. The bare bulb was next placed on the cast-iron bracket in position No. 2, and after operating several days it was found to be satisfactory as to temperature range and continuous operation. A series of calibration tests was then started to learn what combustible losses corresponded to the different temperature readings.

Samples consisting of *all* the ash discharged from the stoker were taken hourly, the ash as it accumulated in the hopper being quenched immediately by means of a water spray. At the end of the hour the ash was dumped from the hopper, crushed, mixed and quartered by hand until it was reduced to about 20 lb. of 4-mesh size, and sent to the laboratory. The analyses show combustible on the dry basis.

The samples from Station A were collected from time to time between Jan. 20 and March 2, 1921, at times when it was convenient to do the work. Usually five to eight samples were taken each day. In all, 107 samples were taken during 15 different days. About half of them were taken during certain stoker tests that were being made on this boiler, and the remainder under every-day operating conditions. No special effort was made to change operating conditions from normal except in the case of a few samples, when more combustible was run over than usual in order to get some high points to establish the upper part of the curve.

Relation Between Temperature and Combustible Loss.

Table No. 1 gives a sample of the data obtained and averaged for each hour, representing

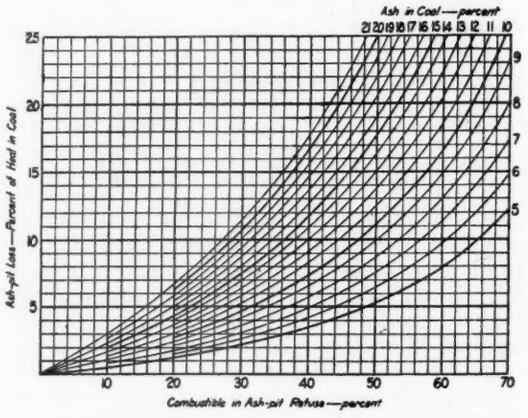


Fig. 4—Relation Between Ash-Pit Loss, Combustible in Refuse, and Ash in Coal.

the conditions existing while taking the 107 samples. The essential results are plotted in Fig. 3, where each small circle represents the average of all temperature readings grouped between 300

TABLE No. 1—ASH-PIT LOSS-RECORDER TEST DATA FROM STATION A.

Date.	Time.	Boiler rating in % Steam flow.	Boiler rating in % Air flow.	Ratio of air flow to steam flow. Total air.	Ash-pit loss rec. temp., deg. F.	Combustion refuse, %.	Heat loss, %.	Grate speed, in. per min.	Draft over fire, ins. water.	Flue-gas temp., deg. F.
Feb. 10, 1921.....	9:00-10:00	170	177	1.04	146	421	21.84	4.50	2.31	0.07	614
(Coal, 10.6 %	10:00-11:00	173	176	1.02	143	590	29.98	7.00	3.76	0.06	616
ash.)	11:00-12:00	173	177	1.02	143	612	29.60	6.80	3.48	0.06	620
	12:00- 1:00	175	177	1.01	141	595	28.56	6.50	4.12	0.07	621
	1:00- 2:00	176	179	1.01	142	597	28.68	6.60	3.97	0.07	620
	2:00- 3:00	174	180	1.03	145	601	30.74	7.30	4.12	0.09	631
	3:00- 4:00	176	180	1.02	143	622	28.14	6.40	3.97	0.10	623
March 2, 1921.....	11:15-12:15	153	152	0.995	139	571	38.15	5.65	3.02	0.02	580
(Coal, 8.4%	12:15- 1:15	149	151	1.01	142	555	35.50	5.04	3.20	0.02	580
ash.)	1:15- 2:15	148	145	0.98	137	564	40.28	6.20	2.66	0.01	580
	2:15- 3:15	105	110	1.05	147	463	36.28	5.23	2.13	0.01	539
	3:15- 4:15	126	134	1.06	149	450	34.66	4.87	2.48	0.01	558
	4:15- 5:15	134	176	1.31	184	478	32.88	4.49	2.84	0.03	591

and 400, 400 and 500 deg. F., etc. It is noted that the ash-pit loss is about 3.5% at 300 deg. F. and increases 1% for each 100 deg. F. temperature rise.

It was first thought best to plot the results between temperature and percentage of combustible in the ashes, but it was found that the ash in the coal varied between 8.5 and 14.0%. From the curves of Fig. 4 it is noted that with samples having 30% combustible the heat loss is 3.9% from the 8.5% ash coal and 7.0% from coal with 14% ash, hence each test was figured on a basis of the heat loss due to unburned carbon, expressed in percentage of the heat in the coal. The relations between percentage of combustible in refuse, ash in coal, and ash-pit loss are given in the series of curves in Fig. 4. These curves are plotted from the formula:

$$\text{Combustible loss} = \frac{100\,ac}{(100-a)\quad(100-c)}$$

where a is the percentage of ash in the coal and c the percentage of combustible in the refuse. This formula is based upon the assumption that all of the ash from the coal goes to the ash pit and that the heating value per pound of combustible in the ash pit is the same as the combustible in the coal.

Emphasis is usually placed upon the percentage of combustible in the ashes as being the true measure of loss due to unburned carbon, but it is of equal importance to know the percentage of ash in the coal. There is more heat lost with 20% combustible in the refuse from a coal with 20% ash than with 40% combustible in the refuse from a coal with 8% ash.

Temperature Varies With Percentage of Heat Lost in Combustible.

One naturally questions whether the temperature of a bulb at such a location will vary with the percentage of heat lost or with the percentage of combustible in the refuse; whether either relation will hold true for different percentages of ash in the coal, or whether it varies with the boiler rating, grate speed, etc. The final answer to such questions can only be determined from results of actual tests. Fig. 3 is plotted from the 107 samples and it shows conclusively that the temperature varies directly with the percentage of the heat of the coal lost in unburned carbon. Various other plots and studies of the individual tests fail to show any tendency for the results to

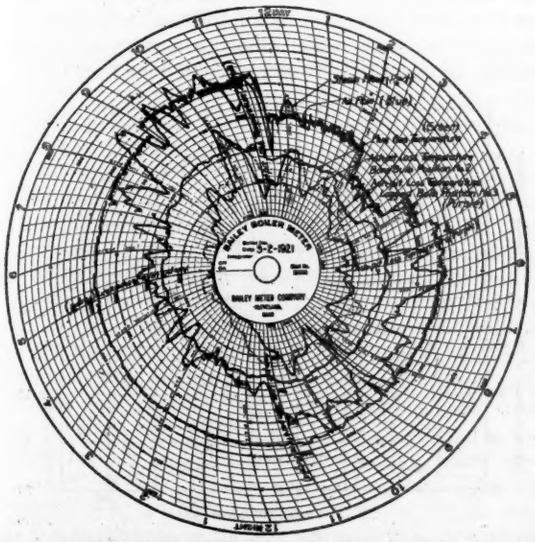


Fig. 5.—Chart From Ash-Pit Loss Recorder in Station A.

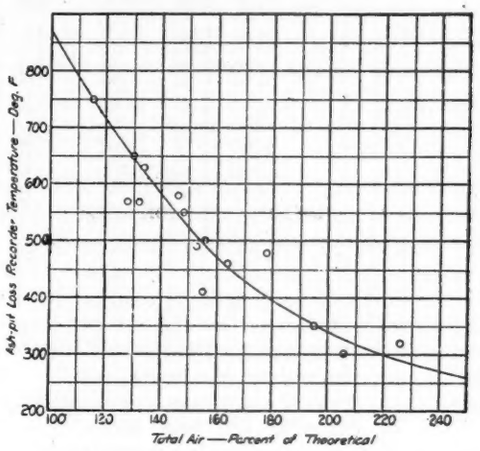


Fig. 6—Curve of Air and Temperature From Forced-Draft Chain-Grate Stoker in Station A.

deviate from this curve due to changes in the percentage of ash in the coal, the grate speed, or the boiler rating.

Performance Results From Chain-Grate Stokers.

Fig. 5 is a chart record which shows certain changes in the relationship between the various factors as the stoker operating conditions change. For instance, the average ash-pit loss is greater when the air-flow and steam-flow pens are together than it is when the air flow reads more than the steam flow. In this case these two pens are together when the excess air is 40%, and the total air increases with the ratio of air flow to steam flow. During the night when the load is light the air flow was permitted to continue at about 180% of boiler rating while the steam flow went down to 80 or 90%, corresponding to a total air of 300%, or 200% in excess of that required for combustion. During this time the ash-pit loss recorder went to the stop which corresponded to 300 deg. for the bare bulb and a temperature of 300 to 350 deg. for the lagged bulb.

Relation Between Ash-Pit Loss and Total Air Used for Combustion.

It is well known that with a chain-grate stoker the ash-pit loss tends to increase as the excess air is decreased, and vice versa. It is only natural that more coal should be wasted over the end of the grate when the fuel bed is kept thicker and carried to the waterback. When the fire burns short a reduction is made in the ash-pit loss, but there is a decided increase in the percentage of excess air. As a matter of fact, this is generally true in all types of stokers, and even in hand firing. That is, a reduction in unburned coal usually means some increase in excess air, so that decreasing one loss increases another. The problem is then to determine what method of operation will give the lowest total loss, and the ash-pit loss recorder makes it possible to plot out

TABLE No. 2—ASH-PIT LOSS-RECORDER TEST DATA FROM STATION B.

Date.	Time.	Boiler rating in % Steam flow.	Air flow.	Ratio of air flow to steam flow.	Total air.	Ash-pit loss-rec. temp., deg. F.	Combustion refuse, %.	Heat loss, %.	Grate speed, in. per min.	Draft over fire, inches water.
Feb. 24, 1921.....	3:30- 4:30	56	105	1.87	303	500	34.10	6.95	....	0.15
	4:30- 5:30	95	116	1.22	197	518	47.85	12.25	....	....
	5:30- 6:30	107	116	1.08	175	602	46.80	11.80	5.00	0.17
	6:30- 7:30	96	122	1.27	206	683	61.85	21.60	5.25	0.15
Feb. 25, 1921.....10:45-11:45		101	123	1.22	197	640	52.05	14.60	4.62	....
	11:45-12:45	105	113	1.07	173	707	58.90	19.20	5 22	....
	4:00- 5:00	68	120	1.77	287	475	36.00	7.55	2.80	....
	5:00- 6:00	107	117	1.09	176	695	49.70	13.22	5.20	....
Feb. 26 1921.....	8:00- 9:00	76	98	1.29	209	247	29.65	5.68	4.00	....
	9:00-10:00	60	112	1.87	303	272	27.70	5.13	2.50	....
	10:00-11:00	71	95	1.33	216	315	29.50	5.60	3.84	....
	11:00-12:00	89	91	1.02	165	454	32.35	6.41	3.85	....
	12:00- 1:00	71	84	1.20	194	460	33.15	6.68	3.97	....

NOTE—Coal had 11.78% ash with 12,732 B. t. u. per lb.

these relations as combustion characteristics of the stoker.

Fig. 6 shows a very definite relation between temperature as indicated by the ash-pit loss recorder and the total air used for combustion on a basis of the theoretical air being 100%. The values taken from the average curve of Fig. 6 are used to calculate the heat losses and are plotted in Fig. 7, showing the characteristic loss curves for a forced-draft chain-grate stoker as operated in Station A. It is quite possible that, with a little better care upon the part of the fireman, the combustible loss could be considerably reduced on this type of stoker, even at this low percentage of excess air. This would then lower

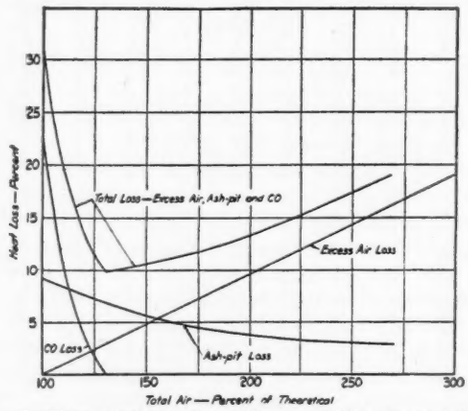


Fig. 7—Characteristic Loss Curves With Forced-Draft Chain-Grate Stoker in Station A.

the total curve so that the combined loss would be still lower than the 10% shown in Fig. 7 as the minimum point.

Fig. 8 shows the relation between the boiler rating and flue-gas temperature, excess air, unburned combustible and CO, with the percentage of heat lost in each. The total of these three losses is seen to be at a minimum of 11% at 225% rating and to remain below 12% at all ratings between 160 and 260%. The minimum loss in Fig. 7 is 10% because the excess-air loss is calculated on the arbitrary basis of 500 deg. F. rise in flue-gas temperature, while in Fig. 8 it is calculated on the actual temperature, which is as high as 650 deg. F. at the higher rating. If it were possible to operate this stoker with lower excess air at the lower ratings and lower ash-pit loss at the higher ratings, the total losses would be materially decreased and the curve would be flatter. In fact, the range of best efficiency as shown in Fig. 7 should be almost entirely independent of boiler rating if the same care is exercised by the fireman at the low ratings as he must exercise at the high ratings to produce the steam. Fig. 5 shows careless operation when the dampers are left open and the same amount of air is used during the light-load period at night as is used during the high load peaks.

Determination of Characteristic Curves of Stokers.

This set of curves raises the question as to whether or not curves can be drawn showing the performance of the stoker itself. Such data have been well established for centrifugal pumps, motors, turbines, fans and blowers, but in the operation of a stoker so much depends upon the character and quantity of coal being burned and also upon the human element of the fireman that the true characteristics of the stoker are usually so clouded that they do not appear in their true form. The three important losses existing in boiler and furnace operation that are chargeable directly to the stoker and furnace are unburned combustible in ashes, unburned gas, and excess air. The latter two losses may be influenced somewhat by the size of the furnace and combustion chamber, and the last one by the leakage of air through the boiler setting, but on the whole they depend almost entirely upon the stoker and its operation.

If the characteristics of the stoker are properly determined, one can then see the best relation between these factors in order that the total of the three losses be a minimum. We are then assured that the furnace efficiency is highest, even though we may not know the exact thermal efficiency of the furnace and stoker itself separate from the boiler. In operating stokers it has been considered

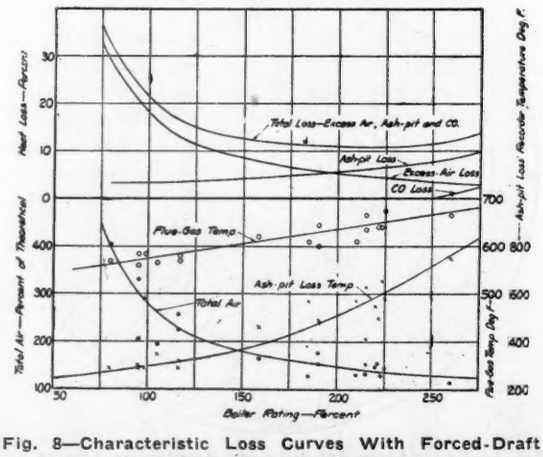


Fig. 8—Characteristic Loss Curves With Forced-Draft Chain-Grate Stoker in Station A.

that the character of the coal and the method of operation were far more important than the characteristics of the stoker itself. This, however, is only an admission that the stoker was not so designed that its characteristics would dominate over the other factors, namely, coal and fireman. Very great improvements have been made in stoker design and methods of operation, but there is need for still further advancement. A careful analysis of the problem by means of continuous graphic records of all the losses and characteristic performance curves like those shown in Figs. 7 and 8 will aid in further improvements in both design and operation, as well as in selecting coal for the stokers or the selection of a stoker for the coal available.

Results From Natural-Draft Chain-Grate Stoker at Station B.

Table No. 2 and Figs. 9 to 13 give all of the data from 13 ash samples and tests on a natural-draft chain-grate stoker equipped with an ash-pit loss recorder as shown in Fig. 1. These data were obtained on three consecutive days from a boiler that was being operated in a stand-by station. The load conditions did not require careful attention to the stoker operation, hence the results should not be taken as indicative of the best performance with this type of stoker. Neither should these results be used for comparing one type of stoker with another, because the operating factors, namely, coal and fireman, may be very different.

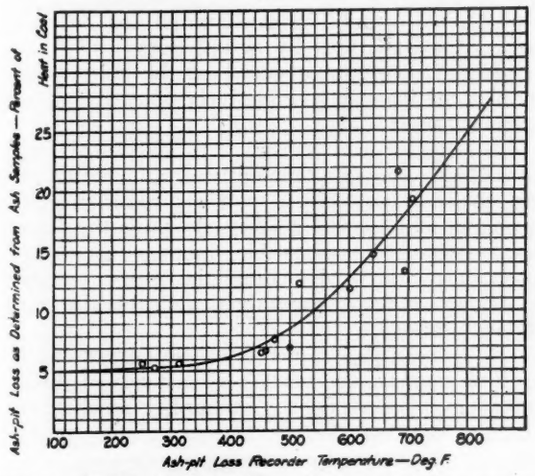


Fig. 9—Relation Between Ash-Pit Loss and Temperature Under Conditions of Fig. 1.

In Fig. 9 the ash-pit loss increases very slowly with the initial rise in temperature, and then more rapidly at the higher temperatures. Referring to Fig. 1, it will be seen that the bulb is located at a different position with respect to the fuel bed from the one in Station A. In Fig. 10 the relation plotted between total air and ash-pit loss-recorder temperature shows widely scattered points. This is largely because the fuel-bed conditions vary rapidly, and there is considerable time lag between the condition of the fuel bed on the grate proper and the amount of coke being discharged at the same time. The log, Fig. 13, plotted over a short period, shows a typical case of the variations as the fire burns thin and is again thickened. The ash-pit loss-recorder temperature

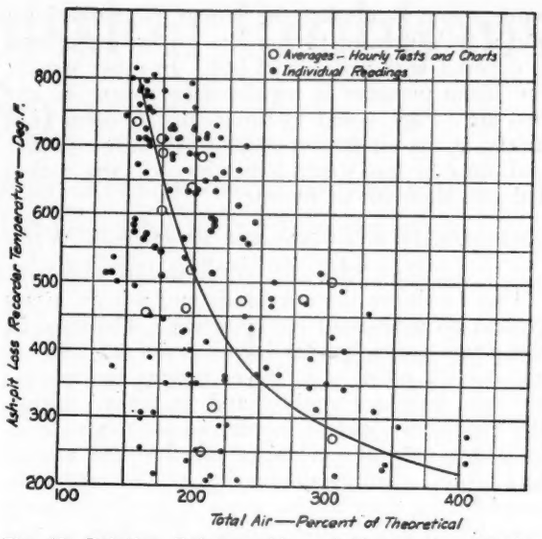


Fig. 10—Relation Between Air and Temperature Under Conditions of Fig. 1.

drops with the short fire, but the lowest temperature is not reached until 20 min. after the greatest air excess and the lowest steam flow. The conditions of the fuel bed on this stoker are sometimes very good and sometimes very poor, just as it may happen, due either to the stoker characteristics, the human factor, or the coal factor, or to a combination of all three. In any case there are certain average conditions which tend to repeat and show the relationship between the various factors.

In Fig. 11 it will be noted that the natural-draft chain-grate stoker in question, as it was being operated at this time, gives the best efficiency at about 210% total air, with a loss of 18% due to excess air and unburned coal. We all know that better results than this can be obtained under suitable load conditions with good operation and the right kind of coal, yet these curves indicate that there is a tendency for the losses to increase very rapidly as the fire changes to a shorter or longer condition from the most economical point. The air having free and equal access to all parts of the grate, takes the path of least resistance through the fuel bed and develops holes very rapidly when once started. In many plants the boilers are operated with the damper wide open. If the maximum amount of steam is not needed the fire burns short, and if

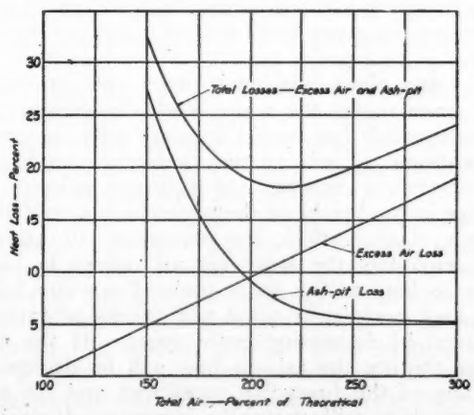


Fig. 11—Characteristic Loss Curves of Natural-Draft Chain-Grate Stoker in Station B.

more steam is needed the stoker is speeded up and a little greater proportion of the grate area is covered with active fuel bed. In other words, the steam pressure is regulated by means of excess air. Figs. 5 and 13 bring out this point very nicely, as the air flow remains practically constant and more or less steam is produced as the coal is fed into the path of the air.

Characteristic Curves for Operation With Natural Draft.

Fig. 12 shows the excess-air and ash-pit losses plotted on a basis of boiler rating. The total of these two losses has its lowest value of 18% at about 90% rating. At lower ratings the excess-air loss increases rapidly and at higher ratings the unburned-coal loss increases even more rapidly. One naturally wonders whether the ash-pit loss would continue increasing at the rate indicated by the slope of this curve if the boiler were operated at still higher rating. The limit in this direction is reached when the space under the water back is completely filled with ash and coke. The percentage of combustible lost when operat-

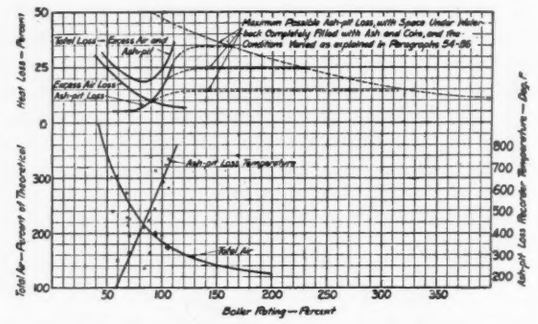


Fig. 12—Characteristic Loss Curves of Natural-Draft Chain-Grate Stoker in Station B.

ing with the space under the water back completely filled with ash and coke combined will depend upon the percentage of ash in the coal, the coal-gate opening and the height of the water back above the grate, and will be practically independent of the speed of the grate.

If the increased rate of combustion is obtained by increasing the gate opening and the intensity of draft, leaving the grate speed and the space under the waterback constant for a given percentage of ash in the coal, a decrease in the ash-pit loss will result as shown by the upper dotted curve at the right of Fig. 12, because there will then be more ash per square foot of grate and therefore less space left for coke under the water-back.

For any given relation between gate openings and space under the water back the percentage of combustible lost would decrease with increased percentages of ash in the coal and should of course remain constant for different ratings. A change in the height of the water back would also have a similar effect, the percentage of ash-pit loss remaining the same for all ratings in both cases so long as the space under the water back was kept completely filled and increased ratings obtained by increasing grate speed. If the fire burns thinner the ash-pit loss will be decreased for any of the foregoing conditions and the excess-air loss will naturally increase. It is believed that characteristic curves like those shown in Figs. 11 and 12, plotted for different relations between the factors that have been mentioned, will be very helpful in obtaining the best results from natural-draft chain-grate stokers. By means of such curves we should be able to accomplish better results in the arrangement of water backs, regulation of coal gate, grate speed, draft, etc., and also assist the fireman in obtaining the required amount of steam with the minimum loss.

From a study of the data obtained the following conclusions may be drawn:

(*a*) The temperature of a bulb properly located near the rear of a chain-grate stoker responds definitely to changes in the amount of combustible going to the ash pit.

(*b*) The changes in temperature vary in direct proportion to the percentage of heat lost to the ash pit when the bulb is properly located.

(*c*) This relation between temperature and ash-pit loss is not materially affected by grate speed, rate of combustion, or percentage of ash in coal, but should be determined for different types of installations by actual tests.

(*d*) A continuous record of the ash-pit loss enables the fireman to effectively control this important factor.

(*e*) Records of ash-pit loss, excess air, unburned gas, flue-gas temperature, and boiler rating, make it possible to plot characteristic performance curves for stokers showing the losses due to unburned combustible, unburned gases, and excess air, and to determine the proper amount of excess air to be maintained and also the most efficient capacity.

(*f*) These stoker characteristic curves can be used to compare the relative efficiencies of different types of stokers, the suitability of different kinds of coal and the effectiveness of the control.

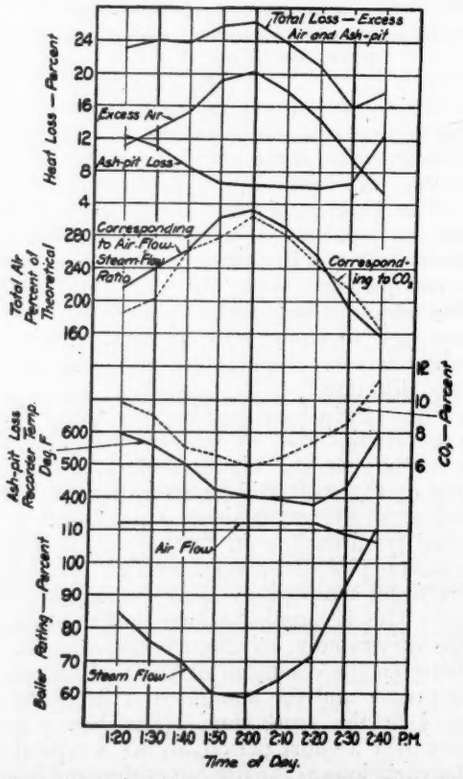


Fig. 13—Log Showing Changes of Fuel Bed on Natural-Draft Stoker in Station B.

Overhead Transmission Problems Being Solved

Insulator Development Advanced to Provide for 220,000-Volt Lines—Pole Treatment Adds to Life — Inductive Interference Eliminated or Reduced to Reasonable Minimum by Co-operation

Difficult and numerous as have been the problems involved in the distribution of electrical energy they are all being overcome as a real need for their solution develops. Ample proof of such a statement is to be found in the reports of various National Electric Light Association committees, together with a review of the discussion following the presentation of the reports at the recent annual convention in Chicago. Wood poles, insulator practice, rural lines, transformer problems, and similar subjects occupied the attention of the Overhead Systems Committee of which W. K. Vanderpoel, Public Service Electric Co., Newark, N. J., was chairman.

The treating of poles has been quite fully covered, and the results obtained with various types of treatment show that the open-tank method of treatment represents a good investment, and also that the brush method of treatment has much value.

In discussing the report, A. O. Austin, of the Ohio Brass Co., took up high-voltage troubles on lines of voltage in the neighborhood of 200,000 volts. He stated that line failures could be attributed to the failure of air around the conductor rather than actual failure of insulators. Illustrations presented showed that very remarkable results in balancing the voltage duty on individual insulator units in a string can be accomplished. By caging the conductor and using various shields it was shown to be possible to avoid flashing at the insulator itself. Pictures shown represented tests at pressures in excess of 500,000 volts.

J. C. Martin brought up the question of the rating of pin-type insulators, stating that insulators might be good for 25,000 volts in one case and for only half that value in another case. Use of wet and dry flash-over valves should give satisfactory ratings from which engineers could select proper equipment, using a knowledge of the conditions to be met in each individual case. E. P. Peck, Utica Gas & Electric Co., Utica, N. Y., expressed the opinion that it would be a serious mistake to leave off the regular nominal voltage rating of insulators. He suggested that standard ratings with standard tests applied to all makes of insulators would cover the situation. R. J. C. Wood, Southern California Edison Co., Los Angeles, expressed the belief that no insulator has a definite rating. Climatic conditions have such an influence that it is impossible to select an insulator for high voltage on a single rating.

G. C. Neff, Wisconsin River Power Co., Madison, Wis., in discussing the question of farm lines, said that utilities in general did not look upon farm lines with favor. The business may be viewed in general from the viewpoint of population; about 50% of our people are living on the farm. The farmer can and does use more energy per customer than the average city consumer. Building of transmission lines may be facilitated by farmer co-operation provided the farmer receives benefits in the way of service in return for concessions which he can give. The farmer is going to have service, and he will have it either from the existing companies and lines or from companies that will be organized. Mr. Neff believes that it is up to the existing companies and the Association to find a proper solution of the farmer-service problem.

Discussion of Methods for Preservative Treatment of Poles.

In discussing preservative treatment of poles, C. E. Fritts, Kansas City Railways Co., brought out interesting points in connection with pressure treatment.

He cited examination of a large number of poles that had been in service for 24 yrs. In 50 poles examined only one was found to be defective, and in the examination of another set of poles 90% were found to be absolutely sound after 16 yrs. service. Long-leaf pine is selected for treating because of its great strength. Poles are cut, peeled, placed on ramps and seasoned. They are then treated at 220 deg. F. Eight pounds of creosote per cu. ft. is left in the pole when finished. Treatment of this nature costs about $15 per pole, treating the pole for its entire length. He recommends use of such poles in any place where lasting qualities and permanent construction is desired. Cedar will not take this type of treatment because of the nature of the wood. The season of the year at which the poles are cut is believed to be important, spring cutting being considered as best because of the fact that the running sap facilitates the peeling process.

White ants do not work through creosoted wood, these being among the worst enemies of poles. Heartwood cannot be penetrated by this type of treatment, but since the poles are dry to start with there is no internal decay. Cut tops and butts will permit decay due to entry of water through these points. Electrical resistance of poles is not lowered by creosote treatment according to tests that have been made.

L. L. Elden, Edison Electric Illuminating Co. of Boston, spoke of use of temperature indicating devices in connection with distribution transformers. He said that such devices can be made to limit investment in transformers by as much as 25%. In making periodic tests such devices are a great aid, eliminating much of the cost of such work. He called attention to the fact that modern transformers designed by A. I. E. E.

standards will not stand 50% overload, as stated in the report.

R. J. C. Wood spoke of transformer failure, stating that trials of transformers with various colors of finish showed grey to be best. However, he stated that a dull and rough surface seemed also to have a decided influence in preventing temperature rise. Experiments with 220,000-volt insulators in an effort to make a 9-unit, 150,000-volt insulator stand a 220,000-volt service, were described by Mr. Wood. Studies are being made at normal frequency. With 12 or 14 units he believes that nothing now stands in the way of 220,000 volt construction.

Inductive Interference Can Be Eliminated by Consistent Practice.

The Committee on Inductive Interference of which A. E. Silver, Electric Bond & Share Co., was chairman, reported that the Committee's work during the year had made possible a more complete appraisal of the issues involved and of their significance to the industry. The seriousness of the problem is increasing in much more than direct ratio to community and industrial development. The increasing extent of lines of both classes and the increasing use of the public highways by each are bringing increased opportunities for interference. The cost of measures of co-ordination and mitigation may reach very large totals. It is vital to the future of the power industry, and to the public interest generally, that this burden of cost be kept to a minimum by improvements in designs and proper co-ordination of facilities, and that this industry be not required to bear more than an equitable share of the costs of correction.

Local power authorities often act without a full knowledge in passing on problems of interference, said Chairman Silver in discussing the report. Central control of studies in Association headquarters has done much to eliminate mistakes. Power companies, if they are to participate in the work of telephone companies, must give a definite measure of co-operation, and all companies should take this matter seriously. Co-operation with headquarters will do much to gather and spread information gained in each individual case. Sacrifices will have to be made in many cases for the advancement of the general good. Advance planning may be made to contribute much in the avoidance of future specific cases.

H. B. Gear, Commonwealth Edison Co., Chicago, in discussing the various problems met, spoke of the division of the tests into classes. Interference with street-lighting circuits was found to be less with metallic circuits than with phantom circuits. In systems having considerable mileage it was found that interference was variable along the line, and that machine loading had a definite influence. Different generators have different effects, but in general the interference is reduced as the load increases.

Slow-speed machines, it seems, are more subject to interference than high-speed ones, but the information now at hand is not sufficient to predict what may result in any case. Voltage, balance, insulation, spacing and transposition all have an influence, but the factors are so variable and numerous that much added work must be done before a final solution of the problems can be made.

Research to Be Conducted in Effort to Solve Future Problems.

The Research Subcommittee, of which A. W. Copely is chairman, has made a general survey in order to lay out a field of research. The power system and the communication system comprise the two factors that must be examined. Resonant shunts, increased telephone currents and other features may be made to reduce the effects of interference. Field surveys should be made by power men whenever possible in order to get all information that may be available in order to be in a position to pass on future problems. Pole diagrams showing all factors of both the telephone and power circuits are essential, and all features of construction are important in preparing data for use of the headquarters organization.

W. J. Canada, director of engineering, Headquarters Engineering Staff, in reviewing the work of the organization, said that it had been believed that interference was a local or sectional problem. Now, however, it is known that the problem is general and wide and that the solution must be sought by all parties involved. Present great systems make former unimportant problems now of great importance.

Troubles that were at times attributed by telephone engineers to power lines have been found to be the result of atmospheric conditions. Power men have handled the problem in manners not of the best, but fortunately this situation is being overcome.

Co-operation of Telephone and Power Engineers to Solve Trouble.

Desirability of co-operation before construction or before trouble actually arises was pointed out by I. E. Moultrop, chairman of the Technical National Section. He said that both the power and telephone companies were working together at the present time, but that many irritating local conflicts would probably arise. R. F. Pack, Northern States Power Co., Minneapolis, Minn., stated that this was a problem that should be solved. By co-operation with telephone engineers it is hoped to establish specific types of cases where trouble may arise. Two classes of cases will be set up—one where there are existing standards, and one where there are no present standards. Actual experience has shown that co-operation with telephone engineers does eliminate trouble when proposed lines are given mutual consideration and study. It is the hope that all problems can be solved by joint state committees, with final appeal, in cases that cannot be so handled, to the National Joint Committee.

O. B. Coldwell, Portland Railway, Light & Power Co., Portland, Ore., spoke of interference in the Northwest and said that his section of the country was much interested in the solution of the problem. Peter Junkersfel, Stone & Webster, Inc., Boston, spoke of the great need of educating the entire power and telephone organizations in order to arrive at a full solution of the interference problem.

H. L. Wills, Georgia Railway & Power Co., Atlanta, told of problems found in the Southeast. He called attention to the need of every local or-

ganization co-operating with the Headquarters organization in an effort to make real progress and accomplish results.

Utility Commission Engineers Advise on Interference Problems.

D. A. Henry, of the Illinois Public Utility Commission, spoke of the many advantages of co-operation, and said that the problems often come to commissions where co-operation failed. In such cases the weight of evidence has a decided bearing in the rulings made. Full and complete cases should be prepared whenever problems are presented to commissions. C. B. Hayden, Wisconsin Public Utility Commission, stated that cases had been well worked out in Wisconsin, but said that solution "out of court" was to be chosen.

A. B. Campbell, Iowa Public Utility Commission, called attention to the farmer-line telephone companies of that state. The Farm Bureau and the associations of contractors should be dealt with in solving local problems where such organizations are in existence. A. E. Nolton, Connecticut Public Utilities Commission, stated that he did not believe that commissions should now establish fixed and detailed regulations. E. H. Morse, North Dakota Public Utilities Commission, told of the passage of a state law regulating interference. Rules prepared following the passage of this law were finally prepared to satisfy the various parties interested.

Bancroft Gherardi, New York City, vice-president of the American Telephone & Telegraph Co., expressed his appreciation of the spirit of co-operation shown by the activities of the committee. He spoke of the great good that would result from a personal acquaintance of telephone and power men. He stated that in the past electric light men have shown a willingness to help in the working out of the various conflicts that have arisen. The telephone companies will get together in the specific cases that arise in the future, with the idea of protecting all interests involved. A similar expression of good-will expressed by Mr. Gherardi at an earlier General Session of the Association was roundly applauded by more than 500 central-station delegates.

Meter Committee Reports on Co-operation of Universities in Training Men.

In addition to discussions of specific technical problems and types of equipment, the "Meter Lecture" featured the report of the Meter Committee of the Technical National Section, of which W. L. Wadsworth, Minneapolis General Electric Co., was chairman. The position revision of the "Meter Code" is a matter which has been brought to the Committee's attention and it is proposed to reprint the code, revised, if necessary, in 1922. Several members of the National Meter Committee, including the chairman, attended the university courses, which were given at various schools during the past year, with the intention of offering every possible assistance and co-operation, and the conviction of all was that the universities are supplying very ably a most urgent need. At Ames, Ia., as well as at Urbana, Ill., where courses previously given were repeated during the past year, both instructors and students were impressed even more strongly than before with the valuable and lasting results obtained. The metermen who attended the courses as students showed by their interest and strict attention to the work that they appreciated the opportunity to make themselves more valuable to their companies.

The National Meter Committee has gone on record as offering every assistance possible to such educational institutions as may conduct courses for metermen, and it is hoped that many other schools and colleges will see fit to open similar curricula for the benefit of both individuals and operating companies.

The conditions under which large quantities of high-tension current is sold in some localities makes it inconvenient or impossible to install the meter equipment in the consumers' premises, and in such cases outdoor metering equipment has been used. While under such conditions it is permissible to install the necessary metering equipment out of doors, it is most important that the meters and instruments should be adequately housed and so located as to facilitate maintenance.

The meter must register accurately the energy used and it cannot be expected to do this unless it is properly protected against the elements and adverse climatic conditions.

In last year's report the Committee called the manufacturers' attention to the demand for a cheaper outdoor metering equipment, light in weight and so designed as to facilitate replacement of parts. No advice of further developments along these lines has been received during the past year, but the Committee assumes that the manufacturers are giving this matter consideration.

Practically all a-c. energy distributed to customers is by polyphase circuits. Previous to this year there has been no generally accepted definition of polyphase power-factor. Recognizing the importance of having such a standard definition, a special joint committee consisting of members from the National Electric Light Association and the American Institute of Electrical Engineers was appointed to report at the 38th annual convention of the A. I. E. E., held at White Sulphur Springs last year. That committee, in its report, submitted two definitions for action at the meeting as follows:

(1) Power-factor in a polyphase circuit is the ratio of the total watts to the (arithmetical) sum of the volt-amperes in the several phases, each measured to a non-inductive neutral point. This definition may be otherwise expressed as the weighted mean of the individual power-factor in the phase (weighted according to the volt-amperes in each phase).

(2) Power-factor in a polyphase circuit is the ratio of the total watts to the vector sum of the volt-amperes in the several phases.

It was agreed that a definition should be drawn up based upon the ratio of watts to reactive kv-a. in the circuit. At a subsequent session of the Standards Committee, Definition No. 2 was tentatively adopted.

Dependence of Power-Factor Measurement Upon Contract Conditions.

There is considerable diversity in the methods of applying power-factor adjustment to contracts, and the method to be employed in measuring power-factor must be so chosen as to meet the contract terms. Among the conditions that may be encountered are the following:

(1) Power-factor for billing period.

(2) Power-factor at time of maximum demand.

(3) Power-factor under normal load conditions.

Perhaps the easiest value to determine is the power-factor for the entire billing period. Where both watt-hour and reactive kv-a-hr. meters are installed on a circuit, this value of power-factor can be determined from the readings on the two sets of meters taken respectively at the beginning and end of the billing period in accordance with the formula previously given. The method may be applied to a single circuit or extended to cover as many circuits as desired.

Printing Meters Required for Complete Record of Load and Power-Factor.

Where power-factor at the time of maximum demand is required it is necessary to install printing devices of some kind so as to periodically record the meter readings. Watt-hour and reactive kv-a-hr. meters equipped with printometers have been used with success to meet this condition. The cost of maintaining the equipment and computing records, however, is high.

Power-factors under normal load conditions may be obtained by a test of short duration, made under the required load conditions. Special test meters may be used for both the kw-hr. and the reactive kv-a-hr. readings. In many cases, however, it is difficult to definitely establish just what normal load conditions are.

One method which has been proposed and used to some extent for obtaining registration under normal load conditions makes use of an extra set of meters for power-factor measurements, and a limiting relay for cutting these meters in and out of the circuit according to load conditions. With this an upper and a lower limit of demand must be chosen within which normal load conditions are assumed to prevail. The relay is so adjusted that it will cut the auxiliary set of meters in the circuit as soon as the lower limit is reached. It also will cut the meters out of the circuit when the upper limit is exceeded. Thus neither a very light load nor an abnormally heavy load will be recorded on the power-factor meter. The advantage of the method is that it eliminates the human element in determining normal operation, and renders it impossible to accumulate leading or lagging kv-a. registration during off-load periods for the purpose of improving the power-factor over the entire billing period.

Ampere-Squared-Hour Meter for Measurement of Line Losses.

A recent development in meters which gives promise of having considerable value is the ampere-squared-hour meter for the measurement of line losses. This meter in reality consists of a watt-hour meter designed to operate on low potential. The current coil is connected the same as that of an ordinary watt-hour meter, but the potential is tapped across a portion of the circuit including the current coil and a fixed resistance. At no load there is no potential on the meter. The potential with load is proportional to the current flowing through the meter. This brings about a registration which is proportional to current multiplied by current, or the current squared.

BUSINESS PROBLEMS STUDIED BY COST ASSOCIATION.

New Sections Will Be Formed in Many Cities Before Coming First Annual Convention Scheduled to Be Held in the Fall.

The Industrial Cost Association, incorporated only last January, has shown its right to leadership in this particular field by the quality and results of the national industrial cost conference—the first of its kind ever essayed—held in East Aurora, N. Y., recently. The conference took up in successive sessions the following topics: Current influences on cost problems, current problems in expense distribution, uniform cost systems, standardization of cost terminology and fundamental principles, and the human elements in costs. This latter subject was treated in two interesting speeches by Harry Tipper of New York City, and I. H. Mills of Brooklyn.

Following a debate a vote showed that the majority present favored the proposition that abnormal burden, largely due to idle plant facilities, should not be included in current monthly costs. A large factor in supplying advance data for this subject was found in a masterly 10,000-word pamphlet written by T. W. Dinlocker, assistant comptroller, S-K-F Industries, Inc., New York City, and A. W. Wainwright, works auditor, S-K-F Ball Bearing Co., Hartford, Conn. This document, printed by the Industrial Cost Association as its first contribution to the literature of the cost world, had been read and studied by most of those in attendance at the conference.

As a result of extensive research, reported on and debated by the plant executives and trade association representatives, the conference agreed that complete uniform cost systems, adaptable to all factories alike, cannot be devised and, also, that the best cost system is one which is developed from the factory end by employes.

By a reorganization effected by the board of directors, due to the resignation of M. F. Simmons, of the General Electric Co., Schenectady, N. Y., as president, J. W. Stannard was elected president, Mr. Simmons remaining a national director. To assist the national secretary-treasurer, A. A. Alles, Jr., whose headquarters are at 1501 Peoples Bank building, Pittsburgh, an executive committee was selected, composed of President Stannard, Horace S. Peck, comptroller of the S-K-F Industries, Inc., New York City, and G. K. Wilson, assistant-secretary of the Sullivan Machinery Co., Chicago. Mr. Peck was appointed chairman of the committee to prepare for the next national conference to be held late in the fall, at which time the association will also hold its first annual convention.

Secretary Alles announced that Boston, Bridgeport, Philadelphia, Rochester, Buffalo, South Bend and Cleveland had, through their delegations, requested the speedy formation of sections centering in these cities. He also stated that Cincinnati, Milwaukee and St. Louis plant executies had made overtures leading up to the establishment of sections in those cities. The Executive Committee announced that the national secretary-treasurer's duties would in part be taken over by them, leaving him the task of organizing sections in industrial centers.

Coal Supply for Power Plants During Coming Year

Required Production Estimated Below that of Year Just Closed —Heavy Demand Predicted for First Months of 1922—Stocks of Fuel Held by Industrial Plants Being Reduced at Present Time

Coal, the chief fuel of our power plants, has been difficult to obtain in assured quantity and quality, and at regular prices, for a considerable period. The reasons for past difficulties are interesting, but of greater present interest is the question as to present and future conditions. Particularly interesting is the question as to what conditions will prevail during the coming winter, and whether or not coal should be stored in large or only moderate quantities to assure a satisfactory supply. It is estimated that between April 1 and June 1, 1921, the bituminous coal required by the country amounted to 71,600,000 tons. During this period a total of 51,669,000 tons was shipped from the mines, leaving a deficit of 19,931,000 tons to be taken from existing stores. The year 1920 closed with stocks of approximately 60,000,000 tons on hand, or probably about 20,000,000 tons more than that required to assure a good supply under normal conditions, according to estimates made by the coal wholesalers of the country.

A total demand for the year up to April 1, 1922, of 500,000,000 tons of bituminous coal is anticipated at the present time by the same men. This demand is divided into two items—one of 465,000,000 tons for actual use, and one of 35,000,000 tons for storage against the possibility of a miners' strike on April 1, 1922, when existing union agreements expire. Records of output in recent years show definitely that the mines are capable of producing such an output without difficulty. In fact, records show that an output of probably 20% or more in excess of such a quantity could be produced to satisfy a demand if it actually existed. The output for 1920 was 556,613,000 tons.

Heavy Demand Possible in First Months of 1922.

It is estimated that the demand for coal will be at a maximum of about 12,500,000 tons per week between Jan. 1 and April 1 of 1922, in order to care for the current needs and to take care of the probable storage of 35,000,000 tons already mentioned. If business in general is good at that time it may be somewhat difficult for the railroads to deliver such a supply regularly. Under date of May 25, 1921, G. O. Smith, director of the U. S. Geological Survey, wrote a letter to J. W. Lieb, vice-president of the New York Edison Co., in which Mr. Smith gave his general views on the coal situation. The letter follows:

"Dear Mr. Lieb:

"Your letter of May 13, asking an expression of opinion as to whether public utility companies should conclude contracts for coal at present, raises a question of business judgment concerning which I should hesitate to offer advice. You ask, in effect, what is a good bargain and what is not, and as business men of long experience the members of your Fuel Supply Joint Committee are supposed to be the best judges of a good bargain.

"However, the Geological Survey's studies of the coal supply, particularly the recent inventory of stocks on April 1, have disclosed certain facts which may be of assistance to the members of your committee in deciding on what course of action is best at present. The statistical data on the stocks of coal carried by electric utilities plants on April 1, were recently published in the Survey's weekly coal report, and similar data on the stocks of coal-gas plants will be made public at an early date.

"In the first place, I think we may say that all large consumers of coal have a private interest as well as a public duty in evening up the demand for coal. The remark that the coal market needs stabilizing is getting trite, but it is still true. We have had many painful experiences in the last 4 yrs., and no one has had better cause to appreciate the evil of a runaway coal market than the manager of a public utility plant, responsible as he is to the public for continuous service.

"The Geological Survey's stocktaking showed that on April 1 the public utilities were in probably the strongest position of all classes of coal consumers. They had in general taken advantage of the depressed condition of the coal industry to build up their reserves, and at the end of the first quarter of the year both electric utilities and coal-gas plants, as a class, carried larger stocks than on Jan. 1. A group of 268 electric plants carried on April 1 nearly twice as much coal as in June, 1920, and even a little more than in early 1919. A group of 102 representative coal-gas plants had on April 1 of this year more than three times as much as in June, 1920, and about the same amount as in early 1919. At the present rate of consumption the electric utilities canvassed had on hand as of April 1 a supply sufficient for 48 days' operation, and for the coal-gas plants the supply was enough for 66 days. This was in sharp contrast to what was happening at industrial establishments, including the by-product coke ovens and steel works. So far as these consumers were concerned there was an almost universal draft on stocks during the first quarter of the year.

"As to what the public utilities have been doing since April 1 we have no knowledge. It is clear, however, that consumers as a whole have depleted further their reserves. That much we

know from the figures of coal production which, in spite of the increase in early April, is still hardly sufficient to meet the current consumption. In other words, the country is still coasting on its reserves.

"Clearly the public utility operator has everything to gain and nothing to lose by continuing to maintain his reserves. It is increasingly plain that the condition of consumers' stocks has a very profound bearing on the coal market. When a man has a large stock he can wait for favorable terms. When his stock is small he has to buy. If something happens to interrupt the orderly flow of coal from mine to place of use he has to buy emergency coal. Now when stocks are generally low a sudden interruption of supply—a blizzard, a switchmen's strike or a traffic jam—finds many consumers unprepared and drives them to enter the spot market. That is the time when a well-stocked coal bin pays for itself. The plant is equipped to withstand a siege.

Market Conditions Influenced by Stocks of Fuel.

"We do not know enough about stocks as yet to be quite sure what constitutes a safe supply, but if we are willing to learn from experience we can hardly escape the conclusion that a stock of less than 30,000,000 tons is not sufficient to meet a severe winter with business active. The country entered the winters of 1916-17 and 1917-18 with about 28,000,000 tons in storage, and in neither winter was the lot of the coal consumer a happy one. Again in the summer of 1920, when stocks fell to 20,000,000 tons, a runaway market developed. On the other hand, in normal times a stock of above 40,000,000 tons seems to be sufficient, and it is significant that the coal market did not tranquilize itself in 1920 until the above-ground reserve passed that figure. A difference of 10,000,000 or 15,000,000 tons, the margin between a safe reserve and an unsafe reserve, does not appear much; it is no more than a week's production at the maximum rate. In fact, however, this small amount is great enough to change the tone of the market.

"There is a sort of critical level of stocks—a critical anchorice temperature, to borrow a phrase from hydroelectric operation. Exactly what the critical level is we cannot say until we have been keeping records longer, and, of course, it would be lower at a time like the present with business depressed and consumption low than in a time of active business. But we can say, I think, that the critical level lies somewhere between 30,000,000 and 40,000,000 tons, and that when stocks are much above that level we have a 'buyers market.' Let them fall much below it and we have a 'sellers market.'

"Now what is the present level of stocks? The Geological Survey's inventory showed that on Jan. 1, 1921, it was not more than 48,000,000 and not less than 42,000,000, say about 45,000,000 tons. By April 1 stocks had dropped to somewhere near 37,000,000 tons, and since then they have doubtless decreased further. In other words, while we can tell from the tone of the market that the critical level has not yet been touched, it is plain that stocks are fast approaching it, and that it would be unwise from the consumer's point of view to let them sink much lower.

"Your question as to the danger of congestion of transportation should the public long delay the purchase of coal has been answered by the railroads themselves. I am not forecasting a period of transportation disability. If business does not revive and we continue to burn coal only at the present rate there is no reason to fear car shortage, for consumption is much below the pre-war level, and prior to the war our transportation system had no serious difficulty in handling the coal offered even with the peaks and valleys of seasonal variation in demand. In those days, however, the country needed less than 500,000,000 tons of soft coal a year. Now our requirements, with business reasonably active, are in the neighborhood of 530,000,000 tons. There has been no corresponding growth in the capacity of the railroads to transport coal, and on the three occasions when we have called upon them to haul 550,000,000 tons of soft coal in a single year the carriers have shown signs of distress. In 1917, 1918, and again in 1920, years in which the output of bituminous coal exceeded 550,000,000 tons, the carriers were able to handle the burden only by being relieved from the responsibility of carrying other types of traffic. As Mr. Gutheim of the American Railway Association has pointed out 'Our railroad facilities are probably adequate today to handle our necessary annual bituminous output, if produced with fair uniformity of rate throughout the year, and will certainly be adequate when post-war rehabilitation of the properties is completed. Our railroad facilities are not and without great waste of investment never can be adequate to handle currently our necessary bituminous coal production when obtained by weekly peaks of 13,000,000 tons and valleys of 7,500,000 tons in a 12-mo. period, as has been the case in the past 2 yrs.' If Mr. Gutheim is right the need for buying early and taking coal while it can be had will be with us for some time.

"But, you may ask, what is the use of a public utility storing coal when other consumers are not? How can the tonnage stored by even all the public utilities stabilize the market if other consumers are holding off and burning up their reserves? The answer is that a reserve is never likely to be needed so much as when other people have none. The more danger from many fires, the more need for insurance on your own house.

"To offset this sense of security which comes from a large reserve, what can the public utility manager gain by delay? To the layman, it would appear that no time could be so favorable to bargain as now when the coal industry is seeking a market for its output. There are three important elements in the cost of coal laid down at the consumer's door which may conceivably change before long—the wage scale, the freight rate and the operator's margin. So far as the first two are concerned the purchaser should get the benefit on all coal delivered after the reduction. So far as the third element is concerned the public utility must decide whether the coal man is likely to accept any smaller margin later when demand is active than now when the market is dead.

"With adequate stocks, however, the public utility is and will be in a strong position to buy, whatever the level of costs and whatever the market position of other consumers. The public utility can not shut down, and the public must

pay for the coal the public utility buys, hence from the public standpoint the double function of large stocks—to keep up service and to keep down prices.

(Signed) "GEO. OTIS SMITH."

From the conditions which the comments by Mr. Smith would indicate as existing, and from the general conditions reviewed by the coal wholesalers, it seems evident that there will be no great difficulty in securing an ample supply of coal for the coming winter season. However, it appears that the present is the time to look into the fuel situation with a view to arranging for the coming needs. The suggestion that freight rates and labor costs may undergo changes in the near future is opportune, and purchasers would do well to see that their interests are properly covered in regard to these items in contracts made at the present time. Facts and figures relative to the general coal situation that may be of interest in considering the present condition apeared on page 285 of ELECTRICAL REVIEW of Aug. 21, 1920.

A PRESERVATIVE POLE TREATMENT WITH CARBOLINEUM.

Brush Treatment Saves Material and Adds Greatly to Life of Old and New Poles at Small Cost Compared to Replacement.

By H. H. GERHARD,
President, C-A-Wood-Preserver Co., St. Louis.

It is just as logical to save preservative used on timber as it is to save the timber. If it is believed that it is false economy to generally give a pole a thorough pressure treatment, treating the entire pole, because the majority of poles do not rot or decay much beyond 1 ft. above or below the ground line, it will naturally be agreed on reflection that there is likewise a waste of material in giving poles a butt-tank dipping or hot and cold treatment.

The majority of poles do not rot at the extreme butt end when placed in the line. Rot usually occurs at the ground line, extending approximately 2 ft. below and 1 ft. above, hence, if a pole is set 5 ft. in the ground, and if the entire butt is treated, 3 ft. of the treatment is wasted, and that 3 ft. absorbs the major portion of the preservative used by the tank or dipping method. The penetration at the ground line, while being deeper by the tank treatment than obtained by the brush method, is of no benefit should the poles subsequently check deeper than the penetration. One can get penetration at the ground line by puncturing the poles with nails or other suitable sharp instruments, and then apply a liberal application of a preservative with a mop or brush.

The rot bacteria, fungus, spore or germ is so minute that it cannot be seen without the aid of a powerful microscope, and in its attempt to enter the timber to feed on the starches and sugars it is killed when coming in contact with a preservative. I have yet to find any man, expert or otherwise, to go on record to say whether the rot "bug" has to travel through 0.001 in., 0.25 in., or 3 in. of poison before it dies. Therefore, if a germicide is applied to the poles which gives a penetration deep enough to offset abrasion or checking its abiding presence will resist the action of the bacteria.

If the poles check in excess of the penetration after erection the earth should be removed to a depth of about 2 ft., the poles should then be allowed to dry and a good preservative applied 2 ft. below and 1 ft. above the ground by the spraying method. That method will insure putting the germicide in the right place by it being blown into all cracks and crevices as well as over the outer surface. After allowing the preservative to dry for a day or so the earth can be replaced. This is not simply a theoretical argument; it has been tried and proven highly effective.

This method of applying a preservative to erected poles suggests that pole users save the poles standing in their lines. It would cost perhaps $0.50, maximum, per pole to use this method and apply the highest quality of preservative. When it comes in contact with the timber it will kill the rot germs present, and by its permanency will prevent the propagation of more. As the labor cost of applying a preservative is the same whether it be crude oil or the highest quality of nonevaporating germicide obtainable the price of the preservative is the smallest feature to consider. A good carbolineum at $0.65 per gal., treating 10 poles to the gallon, will make the cost of application $0.065 per pole. Carbolineum tested by the Government, when applied to poles by the brush method, has increased the life of such poles from 100% to 300%.

ARKANSAS VALLEY CO.'S PROPERTY LITTLE DAMAGED BY FLOOD.

R. G. Hunt, assistant to the vice-president of the Byllesby Engineering & Management Corp., reported last week from Pueblo, Colo., that the Arkansas Valley Railway, Light & Power Co.'s property in the flood district suffered little damage by the recent cloudburst and overflowing of the Arkansas river. There was no break in the Skaguay dam and there were only 150 ft. of flume carried away by landslide. The company's office building and records remain intact. The Canon City power plant was unharmed. Ninety-five per cent of the company's transmission and distribution system in the Pueblo district is unharmed. The steam station at Pueblo will be in full operation within a few days—it being necessary only to dry out the generating equipment with low-voltage current. Meanwhile the company is serving the hospitals, hotels and public buildings, and, so far as the Arkansas Valley company is concerned, normal operation throughout the entire district will be restored very shortly.

U. S. NAVAL ACADEMY WANTS FIVE ELECTRICAL INSTRUCTORS.

An examination will be held in Sampson Hall, U. S. Naval Academy, Annapolis, Md., June 23, for the selection of five instructors in the Department of Electrical Engineering and Physics. The examination will be competitive and candidates found qualified will be eligible in the order of merit as determined by the Board of Examiners, for appointment to fill vacancies in this department.

EDITORIAL COMMENT

Water Power Development

Water power development in the Pacific Coast states is progressing fast enough to meet the increasing demands for electrical energy. The greater development in that section this year is in California where industrial plants, irrigation pumping and domestic appliances are requiring a heavier power load. This greater power demand is the result of increased production of food supplies and other manufacturing operations. One of the basic reasons for both of these is the rapidly increasing population of the state that serves to strengthen the local market; another is the expanding outside market.

In the manufacturing industry the greater use of electrical energy is due not alone to the building of new plants, but partly to re-equipping steam plants with machinery for electric drive. The latter procedure is in harmony with the essential plan of cutting down the consumption of fuel oil which is in excess of production.

At least five of the power companies of California have made plans for developing extensive hydroelectric projects. Several of these are now under construction, and the others will be financed and developed as future needs may be manifested. The consummation of all those projects will amply provide for any probable power demands in the next 10 yrs., including even the electrification of some of the long lines of railway.

In the states of Oregon and Washington the principal power companies have facilities for taking care of power demands, and in the cases of several of them new generating units are being installed to meet anticipated increases in the requirements of consumers. Then, practically all those concerns have undeveloped power sites relative to which either complete or tentative plans for new plants have been prepared, and the possible potentiality of those sites could and probably would be developed to meet any extraordinary demand for power. In the course of the normal industrial growth of those two states at least no shortage of power is likely to occur. In the case of such undertakings as the electrification of railroads additional hydroelectric development could be accomplished by the time the roads were ready for power. If the installation of a hydroelectric plant for the fixation of atmospheric nitrogen on a large scale were contemplated there may be found available sites on the Columbia river concerning which valuable data have been worked out by competent engineers.

Relative to Idaho and Montana it may be stated, also, that the principal power companies have generating facilities sufficient to supply all demands for power and light, with undeveloped sites that might be utilized. It may be observed that investigations of power sites, as to feasibility, either by the Government or by private interests, constitute assets of great value. But, under no greater pressure than the ordinary demands of industry, the development of water power is not likely to be very far in advance of actual present needs.

In the development of any business it is rather difficult to determine what factors are cause and what are effect. The demand for services or commodities sometimes leads their supply, and sometimes the supply is provided in advance of the demand and at times suggests the need or want of such services or commodities. Industry hesitates to locate where either a market or raw materials are not readily available, and industries requiring power in bulk are not likely to locate where power in ample quantity is not assured.

Our record of achievement as a nation should leave no doubt in our minds as to the capacity and willingness of the country to absorb practically all the power that is made available, particularly where such power can be produced by running streams. It would seem that the industry were backward in seeking to expand and serve if it hesitated a moment in pushing through to completion the development of every water power of real economic value for which finances can be secured. With power available industry will use it and humanity will be served.

The Diesel Engine

The question of purchasing a Diesel engine hinges on first cost and maintenance cost of the engine, as there seems to be entire agreement in regard to the fuel economy. At the present time there is a general discussion being carried on regarding the mechanical and operating features of the engine, and exact data on existing installations have not been available in sufficient amount to determine the exact status of this type of equipment. Data of this nature are difficult to obtain and analyze for several reasons. The operating and maintenance costs are vitally dependent upon the man in charge of the engine, and in many cases high repair and maintenance cost has been due to the incompetency or inexperience of the man in charge of operation; installations with the same operating conditions and using the same

grade of fuel and lubricating oil are the exception rather than the rule. Users of the engine, where it is in successful operation, hesitate to publish production costs for fear of a rate-decrease agitation or other results detrimental to their business.

The Summer Service Load

During the past when fuel shortage was one of the pressing problems "summer service," by which central stations served isolated plants, was one of the practices that proved its possibilities. Today summer service presents the opportunity to central station and isolated plant alike to make money for the former and save money for the latter. The isolated plant purchasing summer service from the central station is able to shut down its plant almost entirely, operating just enough to furnish hot water. In the winter time this same plant produces much if not all of its electrical energy as a byproduct to the production of heat. Closing down the plant from late in May until somewhere in September, perhaps, reduces the cost of power considerably and enables repairs to be made that are in many cases badly needed. Money is thus saved on labor.

In the past central stations have charged a high rate for the readiness-to-serve item in their power rates. Those utilities that have adopted a summer-service form of contract have been able to reduce the readiness-to-serve charge so that it no longer penalizes the consumer who requires central station service only part of the year. Further, these same companies have been able to offer attractive energy rates for the isolated plant that can use central station power during the summer months.

An isolated plant operating noncondensing, as most of them do, using the exhaust steam for heating during the cold weather, may use between 7 and 9 lbs. of coal per kw-hr. Only a little of this should be charged to electrical power, however, the major quantity being used for heating purposes. A central station which operates condensing will produce 1 kw-hr. on 3 lbs. of coal, and often considerably less. In the summer, with the heating demand lacking, the fuel consumption by the isolated plant must be charged up against the power output only. On this basis the central station can produce power considerably cheaper than the isolated plant; and can sell it to the latter cheaper than the latter can make it.

With the central station's ability to produce a unit of energy for less fuel than the isolated plant, when the latter cannot utilize the exhaust steam, the low energy charge of the former makes central station service most desirable. That the summer load of the utility is lower than the winter load, and the further facts that the peak load due to the overlapping of the power and lighting loads is absent and that the utility has generating and transmitting capacity on hand, combine to make possible a minimum readiness-to-serve charge.

Under these circumstances a central station should find it comparatively simple to connect up the isolated plant. The more inefficient the isolated plant the greater the saving that accrues to its owner by taking central station service. Past experience has proved that summer service is the thin edge of the wedge for many plants, by which is meant that central station service proves so reliable, so free from the complication and annoyances of the isolated plant and so economical that, eventually, summer service becomes an all-the-year service.

The present weeks are weeks when the utility seeking summer load can best go after the isolated plant. Business depression makes central station service more desirable as the isolated plant tends to become less efficient with light power load. Business depression also makes the isolated plant, or any load for that matter, the more desirable for the central station. Thus with mutual benefits we hope the central stations and isolated plants will get together for the summer at least.

Continuity of Service

During the early days of the electrical industry much consideration was given to the protection of apparatus, and the aim of the operating man was to remove grounds and short-circuits as quickly as possible. This frequently resulted in interrupting service, as circuit-breakers were installed to protect the apparatus against overloads. As electric service spread and systems became larger the importance of maintaining service under all conditions became a more prominent feature, and today continuity of service is regarded as one of the most essential elements of satisfactory power-plant operation.

Electrical apparatus today is much more able to withstand short-circuits than the earlier units. Alternating-current generation is universal on all large systems, and with reactors in series with the generators there is little likelihood of damage to the latter through short-circuits on the line, as the maximum short-circuit current is definitely limited and may flow for a considerable time without injury to the equipment. In addition to this there is to be considered the fact that a sudden opening of a circuit carrying a heavy current produces an abnormal voltage which may be the cause of further trouble. Moreover, the problem of re-establishing service upon a large system after it has been once interrupted is no easy matter, especially where there are a number of generating stations operating in parallel. The re-establishment of normal voltage upon such a system to which

diversified loads may be connected is not a simple matter, and is generally accomplished by bringing up the voltage simultaneously in all stations.

The modern ideal of operation is to keep the generators connected to the line and to localize any trouble which may occur, not allowing it to affect the operation of the remainder of the system. Operating companies have gone to considerable expense in installing equipment which will add to the protection of service. Breakdowns in apparatus are not so much feared as are service interruptions. To provide insurance against interruptions duplicate feeders are frequently installed, and in some cases feeders are ring-connected to attain the same end. Such features add to the complication of the system and provide increased possibilities of breakdowns, thereby making protection again a more complicated problem.

Steam Turbine Reliability

Reliability, which assumes safety, is undoubtedly the first and foremost attribute demanded of the steam turbine for central station service. Economy of operation, which embraces a low water rate and low maintenance charges, while vitally important, is a secondary requirement. There are two different aspects in considering steam turbine reliability or safety, for the two are synonymous. The first concerns the designer of the turbine; the second, the men who operate it. And to a large extent the designer is seriously concerned with the manner in which the turbine he designs is operated, for a design of a unit to be reliable must take into cognizance external as well as internal factors, theoretic and practical, within and beyond the control of the designer who is called upon to allow for them.

The steam turbine, with its extremely high peripheral speeds, enormous stored energy, and concentration of large amounts of energy in a small space is so perfectly balanced, so quiet in operation, and so completely inclosed that attendants are liable to overlook and ignore from familiarity what is going on inside the casing. Although the steam turbine is less spectacular than the reciprocating engine in that there is little noticeable movement, more skill and a higher grade of talent should be used with the former than with the latter because of the higher operating speeds and the greater stored and available energy involved. Operating experience has proved that a defective governor or the careless manipulation of a unit by an attendant may result in stripping of blading, throwing the rotor out of balance or producing unequal expansion, ending in damage or havoc to the machine. When one considers the small clearances between stationary and rotating elements, the intricate blading that is at best of a delicate nature, the high speeds, and that the whole is inclosed and entirely hidden from view, yet remains in service without inspection for weeks and months without shutdown, one can only wonder at the high degree of reliability attained by the turbine of today. Their record of operation is indeed remarkable.

Steam turbines in all capacities have won a well-earned reputation for reliability. Mishaps that have occurred have been traced to causes that can be and it is believed have or are being remedied. Because such a high degree of reliability has been attained is no reason, however, why carelessness in operation should be tolerated, nor why attendants should lose respect for momentum, centrifugal force and the limits of mechanical strength. The steam turbine of the smallest or the largest capacities, when up to speed, possesses energy comparable to that of dynamite. Letting loose of these forces may hinge upon a defective governor, something that did not work, or a careless attendant. Eternal vigilance, continual alertness, ceaseless attention to detail, and a high grade of maintenance are in the best interests of the turbine, those operating it and the service it supplies. Meanwhile, refinements in design go on and every mishap adds to the designers' knowledge of the precautions and materials that must be used.

Discussion of Important Convention Papers

Most electrical conventions are well planned and result in great good to the industry. There is, however, one particular matter in this connection the importance of which, it seems, is sometimes unfortunately overlooked, and that is the provision for bringing out the fullest possible discussion of the topics which come before the meeting. There are able practical men in the electrical field who attend annual conventions of local electrical associations regularly, but who could not be prevailed upon to undertake the preparation of a paper to be read there. Men of this type, if they are given the proper opportunity, can often contribute much valuable discussion to papers prepared and read by others. But this discussion cannot usually be expected to amount to very much unless the papers have been read beforehand by those who might be in a position to offer valuable suggestions or criticisms; and this means, as a rule, that the papers must be printed and copies of them distributed before their final presentation. Some of the state electrical conventions recently held have been particularly strong in every way except in the discussion of papers, and in this one respect they have sometimes been deplorably weak.

THE WEEK'S NEWS

Reports of Important Meetings, Developments and Other Happenings of the Electrical Industry and Its Allied Interests

JOINT CONVENTION OF A. I. E. E. IN SALT LAKE CITY.

In connection with the annual convention of the American Institute of Electrical Engineers to be held at Salt Lake City, Utah, June 21-24, jointly with the Pacific Coast convention, the following circular letter has been sent out by H. T. Plumb, chairman, and Paul P. Ashworth, secretary, of the General Convention Committee, under date of June 6 to the executives of electrical industries in the West:

For the first time the annual convention of the American Institute of Electrical Engineers is to be held in a Western city. Are you interested? For the first time the annual and Pacific coast conventions will be combined. Are you coming? It may be many years before the West has another such opportunity. You are needed at this convention! Let's make this an all Western convention—not a Salt Lake City convention. Will you boost? Four hundred eastern executives and engineers are coming. Can you afford to miss this opportunity of advertising your Western business among these eastern leaders of the industry, while they are out West?

Come and bring your engineer. He needs this convention. The knowledge gained will help your business. If you can't come, will you send your assistant? How about that vacation trip? This is vacation time in Utah. Have you seen Utah's New Wonderland? Special rates are in effect from the entire United States. Ask your local passenger agent for the best way. Western territory gets a special half-fare for the return trip. Act now! Send in your hotel reservations—and don't forget to bring the family.

OHIO ELECTRIC LIGHT MEN WILL MEET AT CEDAR POINT.

Address on "Rate Making" and Symposium on Street Lighting Among Important Subjects Scheduled for Annual Convention.

At a meeting of the Executive Committee of the Ohio Electric Light Association held in Cleveland recently it was decided to have an exhibit at the annual convention of the Association to be held at the Breaker's Hotel, Cedar Point, O., July 12-15. The entertainment program as arranged by the Entertainment Committee for the convention consists of a card party for the ladies on Tuesday afternoon, July 12, also on Wednesday, Thursday and Friday mornings. There will be a Monte Carlo party on Tuesday evening, inland sports on Wednesday afternoon, with the annual dinner in the evening. On Thursday afternoon there will be water sports in the afternoon and a dance in the evening.

The tentative program for the business sessions follows:

Tuesday, July 12, 2:30 *p. m.*—President's address; secretary-treasurer's report; appointment of Nominating Committee; report of Illumination Committee by W. S. Merrill, Nela Park, Cleveland, and a symposium on street lighting.

Wednesday, July 13, 10 *a. m.*—Report of Meter Committee by S. C. Henton, Akron, O., and an address on "Rate Making" by F. A. Newton, Jackson, Mich.

Wednesday, July 13, 2:30 *p. m.*—Report of Transmission and Distribution Committee by Prof. A. M. Wilson, University of Cincinnati, and report of Farm Service Committee by J. C. Matthieu, Dayton (O.) Power & Light Co.

Thursday, July 14, 10 *a. m.*—Report of New-Business Co-operations Committee, Industrial Power and Heating Section, by M. W. Arthur, Akron, O., and Lighting and Merchandising Section by J. L. Gaston, Union Light, Heat & Power Co., Covington, O.

Thursday, July 14, 2:30 *p. m.*—An address by G. C. Maxwell, Ohio Committee on Public Utility Information, Cleveland, also an address by a speaker to be announced later.

Friday, July 15, 10 *a. m.*—Report of Station Operating Committee by Prof. Henry B. Dates, Case School of Applied Science, Cleveland, and election of officers.

POWER STATION ECONOMIES TO BE DISCUSSED.

Program for Annual Convention of Iowa Section, N. E. L. A., Covers Farm-Line Installation Problems and Other Important Subjects.

The Iowa Section of the National Electric Light Association will hold its annual convention at the Inn Hotel, Lake Okoboji (Spirit Lake), Ia., June 22-24. There will be a joint session with the Iowa Electric Railway Association on Friday morning, June 24. The program arranged for the business sessions follows:

Wednesday, June 22, 10 *a. m.*—Report of the president, F. J. Hanlon, Mason City, Ia.; report of the secretary-treasurer, M. G. Linn, Des Moines, Ia.; convention committee appointments; general discussion on the following subjects: (1) Iowa State Association Electrical Contractors and Dealers; (2) Iowa State College—Metermen's Short Course; (3) Financial Reports to Municipal Regulatory Authorities; (4) Municipal Ownership in Iowa; (5) Midwest Division, N. E. L. A.; (6) Membership—N. E. L. A., and (7) The Form of Municipal Franchise.

Wednesday, June 22, 2 *p. m.*—Addresses on "Overcoming Excessive Loss in Farm Lines" by E. L. Fischer, general manager of the Muscatine (Ia.) Lighting Co.; "Reports of Tests on Typical Farm-Line Installations" by V. L. Hein, Engineering Extension Department, Ames, Ia.; (subject to be selected) A. B. Campbell, electrical engineer of the Iowa Railroad Commission, Des Moines, Ia.; "Liability Insurance Covering Electric Transmission Lines" by W. A. Woodward, Iowa Railway & Light Co., Cedar Rapids, Ia., and Mr. Block of Lynton T. Block & Co., St. Louis; "The Law of Tree Trimming for Clearance of Electric Transmission Lines on Public Highways" by Rex H. Fowler, Des Moines, Ia., and "Inductive Interference" by John M. Drabelle, electrical and mechanical engineer of the Iowa Railway & Light Co., Cedar Rapids, Ia.

Thursday, June 23, 9:30 *a. m.*—Addresses on "Modern Power Station Economies" by E. S. Hight, chief operating engineer of the Illinois Traction System, Peoria, Ill., and "Electrical Merchandising" by Ira Steele, commercial manager of the Des Moines (Ia.) Electric Co.; general discussion on the subject of "Electric Cooking and Heating."

Thursday, June 23, 2 *p. m.*—Address on "Valuation and Rate of Return" by L. R. King, valuation engineer of the United Light & Railways Co., Davenport, Ia.; general discussion on the subject of "Rates"; address on

"The Establishment of an Iowa Committee on Public Utility Information" by O. H. Simonds, general manager of the Dubuque (Ia.) Electric Co., and Horace M. Davis, director of the Nebraska Committee on Public Utility Information, Lincoln, Neb.; reports of committees and the election of officers and executive committee.

Friday, June 24, 9:30 *a. m.*—Joint session with the Iowa Electric Railway Association—Address on "The Sale of Public Utility Securities" by H. E. Weeks, treasurer of the United Light & Railways Co., Davenport, Ia.; a discussion of the law pertaining to the regulation of electric and gas rates and street-railway fares in Iowa, presented by William Chamberlain, general counsel of the United Light & Railways Co., Cedar Rapids, Ia., and John A. Reed, general attorney of the Iowa Railway & Light Co., Cedar Rapids, Ia., and report of the Legislative Committee by F. J. Hanlon, Mason City, Ia.

ONTARIO ELECTRICAL UTILITIES TO MEET NEXT WEEK.

Power Supply in Rural Communities and Service in Merchandising Among Subjects to Be Discussed at Niagara Falls Meeting.

"Service in Merchandising" and "Power Supply in Rural Communities" are among the subjects to be discussed at the annual convention of the Association of Municipal Electrical Utilities of Ontario, to be held at the Clifton Hotel, Niagara Falls, Ont., June 23-25.

The program for the meeting follows:

Thursday, June 23—President's address; reports; revision of constitution and by-laws; addresses by commercial members on the following subjects: (a) "Advertising" by L. J. Connell, H. K. McCann Co., Toronto; (b) "Window Dressing" by A. S. Edgar, manager of the Supply Department, Canadian General Electric Co., Toronto; (c) "Sales Campaigns" by E. H. Porte, general manager of the Renfrew Electric Products, Ltd., Renfrew, and (d) "Service in Merchandising" by G. W. Blay, manager of the appliance department, Public Utilities Commission, London, Ont.

Friday, June 24—Illustrated address on "Power Supply in Rural Communities" by J. W. Purcell, farms engineer of the Hydroelectric Power Commission of Ontario, and a paper on "Safeguarding the Users of Electrical Appliances" by W. C. Cale, assistant laboratory engineer of the Hydroelectric Power Commission of Ontario.

Saturday, June 25—A tour of the Chippewa-Queenston Power Development project has been arranged for the delegates.

N. E. L. A. ROCKY MOUNTAIN DIVISION AIDS PUEBLO.

Geographic Organization a Vital Factor in Bringing Relief to Plants and Public in Devastated Territory.

Recalled from the Chicago convention of the National Electric Light Association by the flood situation in Colorado, E. A. Phinney, of the Jefferson County Light & Power Co. of Golden, Col., who is president of the Rocky Mountain Geographic Division of the N. E. L. A., undertook the organization of the resources of the electric light and power companies of the division for the relief of such companies as might suffer damage by the flood. The purpose of the movement was the rendering of service to the public dependent upon the electric utilities. Manufacturers, jobbers and contractor-dealers joined in the movement and rendered to the stricken communities every possible assistance in the form of service to the light and power companies. Supplies, repair parts, repair crews and surplus energy were tendered to these companies. The surplus energy was transmitted through temporary physical connections. The conditions in Pueblo are described in a recent report by President Phinney substantially as follows:

"The Pueblo plant of the Arkansas Valley Railway, Light and Power Co. is shut down. The plant operated until 9:15 p. m., June 3, when water and debris made it necessary to close it.

"The Colorado Fuel and Iron Co. is furnishing 300 kw. from its plant for street lights and for government and hospital service buildings. The local company is building a line from Canon City, and when completed within the next 2 days this will supply 1500 kw. for general use.

"Robert G. Hunt and H. Greenacher of H. M. Byllesby & Co. are on the ground supervising the required repairs to the plant.

"Electric light and power companies in all parts of district and from many sections of the country have offered assistance, but at present we have all the help needed. All such companies in this division stand ready to send engineers, foremen and experienced labor upon request. The Rocky Mountain Geographic Division is well organized to handle relief.

"James F. Chapman, chief engineer of the Colorado Fuel and Iron Co., is deserving of particular mention for the part he played in meeting the emergency and for co-operation given. L. M. Cargo and A. F. MacCallum of the Westinghouse service department, and A. L. Jones, L. S. Ickis and B. C. J. Wheatlake, engineers of the General Electric Co., are on the job and rendering invaluable assistance."

DISCUSS INDUCTIVE INTERFERENCE AT GALVESTON MEETING.

Prime Movers and Power-Factor Meters and Measurements Among Subjects Discussed by Southwestern Electrical and Gas Association.

The 17th annual convention of the Southwestern Electrical and Gas Association held recently in Galveston, Tex., was featured by the following addresses and papers: "Boiler-Room Operation" by W. A. McDonald, superintendent of power of the Houston (Tex.) Lighting & Power Co.; "Condensers and Other Station Auxiliaries" by E. T. Keck, superintendent of power of the Texas Power & Light Co., Dallas, Tex.; "Prime Movers, Electrical Apparatus and Switchboards" by C. A. Lilly, superintendent of power of the Fort Worth (Tex.) Power & Light Co., and C. H. Braunig, San Antonio (Tex.) Public Service Co.; "The Technical and Operative Education of Employes" by F. C. Taylor, Eastern Texas Electric Co., Beaumont, Tex.; "Designs and Methods of Overhead and Underground Construction" by J. H. Gill, assistant general manager of the Dallas (Tex.) Power & Light Co.; "Power-Factor Meters and Measurements" by E. P. Speer, Texas Power & Light Co., Dallas, Tex., and "Meter Designs and Testing" by W. F. Eblen, Houston (Tex.) Lighting & Power Co.

At one of the sessions an illuminating demonstration was given showing the quantity, quality and safety side of industrial lighting.

W. J. Canada, engineering department of the National Electric Light Association, gave an interesting address on "Inductive Interference," which produced considerable discussion.

An idea which was introduced by the Southwestern Association at this year's convention, and which it is now intended to retain as permanent, is based on the policy of the National Electric Light Association of continuing the work of one convention through to the next meeting by permanent committees of each division. The chairman of the Light and Power Section chosen for the ensuing year is J. C. Kennedy, superintendent of operation of the America Public Service Co., Dallas, Tex., and the chairman of the Street and Interurban Railway Section is Alves Dixon, superintendent of the El Paso (Tex.) Electric Railway Co.

The election of officers resulted as follows: President, C. E. Calder, Dallas, Tex.; first vice-president, Alba H. Warren, El Paso, Tex.; second vice-president, S. R. Bertron, Jr., Houston, Tex.; third vice-president, John W. Carpenter, Dallas, Tex., and treasurer, J. M. Dickey, Houston, Tex. Executive Committee: Burr Martin, A. Hardgrave, C. E. Calder, Alba H. Warren, H. C. Morris, Charles W. Davis, S. R. Bertron, Jr., F. D. Murphy, W. B. Tuttle, G. H. Clifford, Howard Smith, R. J. Irvine and D. A. Hegarty.

PLANS COMPLETED FOR A. M. E. S. SUMMER MEETING.

From all indications the fourth summer meeting of the Associated Manufacturers of Electrical Supplies to be held at the Griswold, Eastern Point, New London, Conn., will be one of the largest and most interesting. While the meetings only cover the period of June 27-30, many members are planning to be at the resort from June 25 until after July 4.

The schedule of section meetings, which appeared on page 949 of last week's issue of ELECTRICAL REVIEW, was tentatively arranged by General Secretary Charles E. Dustin, and on Tuesday evening, June 28, a banquet will take place, followed by informal dancing and entertainment, during which the recently organized Radio Apparatus Section will give a demonstration of wireless telephone communication with inland cities and ships at sea.

For the golfers a tournament has been arranged and the "Gage Trophy"—a handsome silver pitcher—and other prizes will be competed for. The other outdoor sports and activities available insure a thoroughly enjoyable time for everyone attending. Special rates for hotel accommodations can be obtained and reservations should be made through the office of the association secretary, 30 East 42d street, New York City.

EQUIPMENT ORDERED FOR AUTOMATIC SUBSTATIONS.

Announcement has just been made that the consolidated Coal Co. of St. Louis has placed an order with the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., for 10 motor-generator sets with automatic switching, and two sets of automatic-switching equipment for two motor-generator sets already installed. This order includes three 100-kw. sets, six 150-kw. sets and one 300-kw. set, and two sets of automatic-switching equipment for two 300-kw. motor-generator sets already installed.

The scheme of control to be employed is practically the same as that used in connection with apparatus that is now in service in many railway substations. The equipment furnished for this order is so arranged that the starting and relay panels will be placed above ground, with the motor generators and d-c. panel located underground. The scheme as worked out requires no control wires between the a-c. and d-c. panels, the a-c. power cables being the only connection between the starting panels and the motor of the motor generator. By the proper selection of relays absolute protection to the set is provided at all times against improper condition of the power circuit, trouble within the set itself, or trouble on the load side. Starting is effected by energizing the high-tension line from the power plant through relays which start the several equipments at intervals of 30 sec.

The equipment provides protection against single-phase starting and running, reversed-phase starting on low voltage, reverse current, overspeed, reversed polarity, and running with hot bearings. It is arranged to allow overloads within the capacity of the set, but will shut down when the overload has continued to the point of injury. It permits operation of the converting unit to the maximum capacity which it will stand without injury.

All functions of the control are dependent on the proper condition of the electrical circuit and the proper functioning of the preceding relays. Nothing is left to chance or is dependent on time or mechanical operation. This is by far the largest order ever placed by a coal company for automatic substation equipment, and is believed to be the largest number of units ever ordered at one time by a customer. K. E. Schrieber of the Industrial Engineering Co., of St. Louis, acted as consulting engineer in planning these developments and in specifying the equipment.

SECRETARY HOOVER CONFERS WITH TRADE REPRESENTATIVES.

The general functions and activities of trade associations were discussed at a recent conference held at Washington between Secretary of Commerce Hoover and a committee representing the American Trade Association Executives. The executives' association is made up of representatives of old and established organizations of manufacturers and distributors of single lines of goods or services. Representatives of the trade associations assured Mr. Hoover of their hearty approval of his statement in which he set forth the position of the administration respecting trade organizations. They were told by the Secretary that he was convinced trade bodies have contributed largely to efficiency in industry and that collective effort, within the proper lines, has the approval of the Government. A smaller number of associations, Mr. Hoover said, have engaged in questionable practices.

The Commerce Department, Mr. Hoover said, intends using the trade associations as one of the points of contact between the Government and

industry. The association executives expressed a willingness to co-operate fully and voiced the hope that such co-operation would bring a new era of understanding between the Government and business. Mr. Hoover expressed the belief that one result of co-operation by the department with the associations would be the furtherance of plans for giving wide distribution to helpful production and distribution statistics. He indicated that figures given by the industries to the department would be regarded as confidential and that use would be made of them in no manner that might be objected to by the industries.

PUBLIC RELATIONS FEATURES CONVENTION IN PORTLAND.

The Northwest Geographic Division of the National Electric Light Association opened its convention at Portland, Ore., June 15, with an attendance of 150. Franklin T. Griffith, president of the Association; E. V. Kendall, director of public works for the state of Washington, and M. H. Aylesworth, executive manager of the National Electric Light Association, all gave interesting and instructive talks during the first session. President Griffith discussed methods of financing utilities to meet the great demands being made for increased service.

Public relations featured the talks of the other two speakers, who pointed out the benefits to be derived from telling the average man—the user of service—the "story" of electricity. The important subject before the convention appears to be the question of public relations. Further details relating to following sessions of the convention will appear in a later issue of ELECTRICAL REVIEW.

ARKANSAS UTILITY CONSTRUCTING TRANSMISSION LINE.

The Arkansas Light & Power Co. of Pine Bluff, Ark., has started construction of a 33,000-volt line from its substation at Stuttgart to Clarendon, whence the electricity will be distributed to Clarendon, Brinkley and Cotton Plant by the Arkansas utility company. The line will cost $60,000, and is expected to be completed by July 15. This line will connect with the Arkansas Light & Power Co.'s high-tension system serving Stuttgart, DeWitt, England, and a number of other towns in the Arkansas rice section, with electricity generated at Pine Bluff and Picron. The Arkansas Light & Power Co. also operates electric and water systems in a number of other cities of Arkansas, altogether serving 30 communities. H. C. Couch, president of the Arkansas Light & Power Co. is also president of the Pine Bluff Co., operating the street-railway, electric and water systems in Pine Bluff.

WESTINGHOUSE CO. STOCKHOLDERS' ANNUAL MEETING.

The annual meeting of the stockholders of the Westinghouse Electric & Manufacturing Co. was held in the executive offices of the company at East Pittsburgh, Pa., June 8. At this meeting four directors were re-elected for a term of 4 years; James D. Callery, chairman of the board, Philadelphia Co. of Pittsburgh; Paul Cravath, Henderson, Leffingwell & de Gersdorff of New York City; Harrison Nesbit, president of the Bank of Pittsburgh. In addition to these, one new member, William H. Woodin, president of the American Car & Foundry Co. of New York City was elected. Mr. Woodin had previously filled the unexpired term of George W. Davidson, who recently resigned.

The annual report for the fiscal year ending March 31, which was recently issued, was presented at this meeting and accepted.

LIGHTING EXHIBIT AT BOSTON.

The Bureau for Better Illumination held an exhibit and demonstration of modern industrial lighting at the Massachusetts Institute of Technology, Boston, June 15.

N. E. L. A. DIVISION TO MEET.

The 13th annual convention of the New England Geographic Division of the National Electric Light Association will be held at the Hotel Griswold, New London, Conn., Sept. 6-9.

COMING CONVENTIONS.

American Society for Testing Materials. Annual convention, Asbury Park, N. J., June 20-24. Headquarters, New Monterey Hotel. Secretary, C. L. Warwick, 1315 Spruce street, Philadelphia.

American Institute of Electrical Engineers. Annual convention jointly with the Pacific Coast convention, Salt Lake City, Utah, June 20-25. Secretary, F. L. Hutchinson, 33 West 39th street, New York City.

North Central Geographic Division of the National Electric Light Association. Next convention, Duluth, Minn., June 21-23. Headquarters, Spaulding Hotel. Secretary, H. E. Young, 15 South Fifth street, Minneapolis, Minn.

Iowa Section of the National Electric Light Association. Annual convention, Lake Okoboji (Spirit Lake), Ia., June 22-24. Headquarters, The Inn Hotel. Secretary, M. G. Linn, Des Moines, Ia.

Association of Municipal Electrical Utilities of Ontario. Annual convention, Niagara Falls, Ont., June 23-25. Headquarters, Clifton Hotel.

Associated Manufacturers of Electrical Supplies. Summer meeting, Eastern Point, New London, Conn., June 27-July 2. General secretary, Charles E. Dustin, 30 East 42d street, New York City.

National Council of Lighting Fixture Manufacturers. Midsummer meeting, West Baden, Ind., July 6-8. Secretary, Charles H. Hofrichter, 231 Gordon Square building, Detroit avenue and West 65th street, Cleveland.

Wisconsin State Association of Electrical Contractors and Dealers. Summer outing and business meeting, Waupaca, Wis., July 9-11. Secretary, H. M. Northrup, 23 Erie street, Milwaukee.

Ohio Electric Light Association. Annual convention, Cedar Point, O., July 12-15. Headquarters, Breaker's Hotel. Secretary, D. L. Gaskill, Greenville, O.

National Association of Electrical Contractors and Dealers. Anniversary convention, Buffalo, N. Y., July 18-23. Headquarters, Lafayette Hotel. Secretary, W. H. Morton, 110 West 40th street, New York City.

Pennsylvania State Association of Electrical Contractors and Dealers. Semi-annual meeting, Buffalo, N. Y., July 19. Headquarters, Lafayette Hotel. Secretary, M. G. Sellers, 1518 Sansom street, Philadelphia.

New England Geographic Division of the National Electric Light Association. Annual convention, New London, Conn., Sept. 6-9. Headquarters, Hotel Griswold. Secretary, Miss O. A. Bursiel, 149 Tremont street, Boston.

Illuminating Engineering Society. Annual convention, Rochester, N. Y., Sept. 26-30. General secretary, Clarence L. Law, 29 West 39th street, New York City.

COMMERCIAL PRACTICE

New Business Methods, Policies, Rates and Kindred Central-Station Matters for the Man Engaged in Selling Electricity

PUBLIC UTILITY CONDUCTS SCHOOL FOR LINEMEN.

During the past 5 mo. there has been in progress at Waukegan, Ill., a training school for student linemen under the general supervision of Theodore Blech, superintendent of the Public Service Co. of Northern Illinois. Under this scheme a limited number of inexperienced young men who appear to be of promising material are taken on as student linemen, receive regular pay and are put in charge of an experienced foreman as instructor. In the pole yard facilities are provided for putting up and taking down lines, setting and removing transformers, making complicated transformer connections, learning to climb poles, etc., so that the student soon becomes capable of running pole extensions and services. Operations are repeated over and over until the student becomes proficient.

The practical work is supplemented by instruction 1 hr. each morning under one of the men in charge of the various departments, such as the district superintendent, chief clerk, line foreman, inspector and meter-department foreman. In this way the student absorbs theory as well as practice. So far, five students have been transferred to other districts, and while not qualified to go to work immediately on live lines, they have had the advantages of an intensive training that should aid them in developing into efficient and valuable men. Results are being watched with interest.

INTERESTING PHASE OF CENTRAL-STATION WORK.

Paper by F. F. Kellogg, of N. E. L. A. Committee on Commercial Service, Shows How Complaints Should Be Handled.

Without doubt the central-station business, in common with other present-day industries, must look forward to a period of readjustment, not only in the various interests which it serves, but also in its own internal organizations. The chaotic condition prevailing during the last 5 yrs. has taken its toll in nearly every line of endeavor and the central stations today also find themselves crippled in some respects. While the demands made upon their capacity during the war period have decreased to some extent, the loss of trained men and the consequent disrupting of their former organizations has made it important that the central stations make every effort to rebuild in order that they may continue to furnish efficient service to meet the demands being made upon them.

For several years past, during the war period, and until recently, the public, absorbed in an era of unprecedented prosperity, has given little thought to complaints other than those resulting from the inability of the central stations to supply service to meet the unusual demands for additional capacity. This condition left the central stations somewhat free from the usual run of complaints to which they previously were subjected. With the return of business to a normal state the public will become more exacting, and it seems an opportune time now to give careful consideration to the matter of complaints and complaint prevention.

The old adage, "An ounce of prevention is worth a pound of cure," is most applicable to the complaint ailment, as unquestionably the best remedy for complaints is to so conduct our affairs that there is no occasion for them. The education of the public during the fire prevention campaigns carried on by the fire insurance companies and the various municipalities has had a marked effect in decreasing the number of fires, and the sanitation and health campaigns carried on by the life insurance companies have gone a long way toward preventing disease and making safer communities for us to live in. The same principle undoubtedly holds true in the central-station industry. A campaign of education, not only of the public, but of our own organizations, will undoubtedly reduce to a minimum the number of complaints received.

The first problem usually confronting the central station in the handling of its complaints is to which department of its organization this work shall be assigned. A plan that works out most advantageously in one company frequently is entirely inadequate for another, partly due to the differences in organization and to the lack of departmental specialization which is obviously impracticable in the smaller companies, where the position of complaint adjuster must be combined with one or more other duties. A general principle which can be safely applied to all companies regardless of size is to permit the billing department to adjust all complaints arising from errors in making out or calculating bills. If, however, correcting the bill does not satisfy the complainant, the matter should then be referred to a department maintained especially for handling and adjusting complaints, as recommended by the Committee on Commercial Service and Relations with Customers in its 1917 convention report. If the maintaining of a separate department is not practicable, the complaints should be referred to some other department designated to combine this function with its other duties. It is obvious that such a department should be the department dealing most directly and constantly with the public.

Whether the adjusting is done by a separate department or is combined with the duties of some other department, dealing with the customer in the matter of adjustments comes directly within its province, and this most important part of the company's work should not be handled by any other department. Small and apparently unreasonable complaints may grow in magnitude, even to the extent of complaint being made to the regulatory body having justification. The proper time

to adjust and dispose of a complaint to the entire satisfaction of the customer, if at all possible, is before the complainant leaves your office. The necessity of having a thoroughly competent person to handle this work is obvious.

To intelligently study complaints, they should be divided into three general classes, so that once classified it becomes necessary to apply only general business principles, modified to meet the particular case, to make a satisfactory and permanent disposition of it.

The first class of complaints are those resulting from improper accounting, such as errors in billing due to incorrect meter reading, application of rate, etc.; the second class consists of complaints resulting from the supplying of improper or inefficient service to the customer, and the third class comprises those complaints resulting from improper or inefficient service due to conditions on the customer's premises or due to installation for which the customer is responsible and over which the company has no control.

Complaints belonging to the first class, those resulting from errors in accounting, are usually adjusted by a corrected bill being returned to the customer. Errors of this class are usually found by the customer and are not reported unless the customer expects to benefit. Consequently, only a small portion of errors that would benefit the company ever come to light, and it is seldom that the amount of such losses can be determined or even estimated. That they do exist, however, was evidenced recently by the fact that one of the larger companies, through its failure to apply the proper constant to a meter reading for a considerable period, underbilled a customer several thousands of dollars. A corrected bill was finally rendered this customer and the company stood a material loss in the final settlement of the account. It is obvious therefore that only competent, trained employes should be employed in this work.

Complaints belonging to the second class, those resulting from improper or inefficient service, may arise where an outage occurs due to failure in the company's distributing system or from any other cause for which the customer is not responsible and which prevents him from receiving adequate and continuous service. Under such circumstances the customer usually has sustained some loss and expects the company to reimburse him in whole or in part. It is the practice of most of the larger companies, and should be with the smaller companies, not to attempt to guarantee delivery of service. It is practically impossible for any company to so control and safeguard its system, extending over many miles of distributing lines radiating in all directions over its territory, as to safely guarantee the continuity of its service. No attempt should be made to reimburse a customer in such cases, unless the failure of service beyond question is due to negligence on the part of the company, in which case the customer could recover under due process of the law. Otherwise the company would virtually be carrying insurance on the customer's service for his benefit. This would result in discrimination, and the continuance of such methods must eventually lead to dissatisfied customers whose demands are not fully met. It is obvious that only a competent person trained not only along these specific lines but familiar with all phases of the company's work and its relation with the public, should attempt to adjust such cases.

With complaints of the third class, whose cause is some condition in the customer's installation for which he is entirely responsible, the remedy undoubtedly lies with the customer, and any necessary changes or repairs should be made by the customer or at the customer's expense. Considerable patience and tact are necessary to convince such customers as to the cause and the proper remedy for their complaints, as no one is particularly pleased to be shown that the fault is his. The complainant must also be satisfied and leave in a friendly state of mind, otherwise the next time his complaint may be justified and he will be very much harder to deal with. In complaints of this class there is no liability on the part of the company whatsoever, but it must be remembered that public good-will is a very valuable asset and it is much easier and less expensive to retain than it is to regain after once having been lost.

COMMUNITIES SERVED MADE BASIS OF UTILITY'S ADVERTISING.

With the object of interesting the public in the attractiveness of its stock as an investment, the Middle West Utilities Co., Chicago, recently utilized space in the local newspapers to call attention to the scope and extent of the service it is rendering to its customers. A reproduction of the advertising copy graphically sets forth the communities served by the company with electric light, power, gas, transportation, etc.

Middle West Utilities Company
Serving Two American Cities and Towns
An Investment Backed by the Essential Needs of 1,300,000 People
SELDOM will you find an investment combining safety and attractive yield to the extent offered you in the 7% Prior Lien Stock of the Middle West Utilities Company.
Pays You Nearly 8%
This stock is offered in blocks made up of two shares of Prior Lien Stock and one share of Common Stock and may now be purchased at $180 per block, either for cash or on monthly payments so as to yield nearly 8% on the investment plus additional profit possibilities on the Common Stock.
Back of this investment are the essential needs of over 1,300,000 people residing in the 15 states above indicated for electric light, power, gas, transportation, ice and water service.
Reserve your shares today!
Investment Department
Middle West Utilities Company
Room 1110, Edison Building

Sample of Local Advertising Matter Used by the Middle West Utilities Co.

OPERATING PRACTICE

Methods and Problems Embracing Operation and Installation of Power-Plant Equipment and the Distribution of Electrical Energy

V-NOTCH FOR MEASURING BLOW-DOWN WATER DISCHARGE.

Economy Requires the Checking of Every Unit of Heat in a Boiler, Including Leakage and Waste From Blow-Off Lines.

Feed water is an item for measurement which should be accounted for in the figures for station efficiency. The V-notch water meter and the Venturi meter are proving to be practical types for this purpose. If the V-notch meter is used, precaution should be taken to install the meter so that it will not be subject to surges which will affect its accuracy.

The V-notch meter has also come into use for measuring blow-down. When used for this purpose it should be installed in connection with a tank so as to permit the use of a meter of smaller capacity. One make of meter built for this purpose has an auxiliary pen which magnifies small rates of flow and furnishes an indication of any leakage through the blow-down valves.

On account of the evaporation a blow-down meter will not record the total blow-down and an allowance must be made for this. Theoretically at 200 lb. pressure there is about 19% evaporation. In practice, however, it is not so high as this, depending upon various factors, such as the length of the blow-down line from boiler to vent, the duration of the blow-down, and the temperature of the water in the mud drum.

The increased interest in the question of efficiency in the steam plant within the past few years and the necessity for making each pound of coal produce the maximum work in these days of expensive coal has extended the practice of measuring all quantities which have any bearing on the efficiency or economy. Thermometers on the steam line, the condensate, the feed water and the oil line, U-tubes and barometers for measuring vacuum, steam-flow meters installed on each unit, thermometers on the entrance and exit end of the economizer, recording flue-gas temperatures and water temperatures—all these may be used to advantage in pointing out where the losses are greater than they should be and during what period the condition exists.

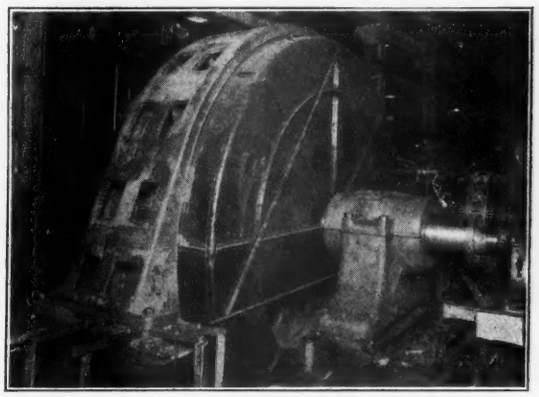
HORIZONTAL WATERWHEEL GENERATOR OF LARGE SIZE.

Special Features Incorporated in Machine to Supply Service to 165.000-Volt Transmission System.

The General Electric Co. has recently completed the largest horizontal waterwheel-driven generator ever built by it. The machine is one of two being built for the Great Western Power Co. of California and will be installed in the Great Meadow plant on Feather river. It is a 3-phase, 60-cycle machine, rated 22,222 kv-a. at 90% power-factor, 11,000 volts and 171 r.p.m.

The fact that it was built to operate on a 165,000-volt transmission line, the highest operating voltage to be reached so far in this country, caused some interesting features to be incorporated in its construction. It was designed with special reference to line-charging requirements. Silicon steel was used in the construction of the armature to minimize core loss. Tests made at the factory on the generator show that it has 97.25% efficiency at full load, and unusually high efficiency at partial loads—95% at half load, and 93% at quarter load. All efficiencies were at 90% power-factor.

The rotor consists of four separate wheels made into a single spider, with the rim dovetailed to receive the poles. The machine is inclosed for ventilation, having air inlets on each side consisting of ducts coming from underneath. The heated air is expelled into the room. Some of the dimensions are as follows: Total height over all, 21 ft.; distance over the end shields, about 7 ft., and distance from the floor line to the top of the machine, 13 ft. The total net weight is 334,000 lbs.



Horizontal Water-Wheel Generator for Great Western Power Co.

The illustration shows the machine as set up for testing at the factory. The intake ventilation ducts are not assembled, but the openings can be seen under the bearing. The projection of the armature shaft is for the application of the water wheels of which there are two, one on each end of the shaft.

LARGE HYDROELECTRIC PLANT COMPLETED ON RHONE.

Special interest is being shown in the completion of a hydroelectric plant of 20,000 hp. by the Société Hydro-Electric of Lyon, a branch of the Compagnie du Gas, of Lyon, and the Compagnie

Continentale Edison, of Paris, at Seyssel, Haute-Savoie, France.

Southwest France, with its many streams and mountains, offers wonderful opportunities for development of hydroelectric power. Much progress has been made along this line in the last few years, particularly in the Department of Isere. The plant recently completed, however, is the largest one yet put in operation. There is a measure now being considered by the French Government for the navigation of the Rhone river above Lyon, in which provisions are considered for the utilization of the hydraulic force of this swift-flowing stream. It therefore appears to be only a question of time before the growing industries of this region will have gone a long way toward solving the perplexing fuel problem by obtaining the necessary power from hydroelectric plants.

The plant recently finished is equipped with four turbines, each capable of developing a total of 5000 hp. It is proposed to install another turbine at an early date and thus increase the production to 27,000 hp.—an amount that equals almost one-third of all the energy consumed by the city of Lyon.

STRENGTH AND INSULATING VALUES OF VARIOUS MATERIALS.

It often happens that a motor coil or some other similar part has to be reinsulated, or that insulating material must be provided for some new piece or part of an equipment. Anyone can wind on a quantity of rubber tape or varnished cloth and "guess" that the job is well done and safe, but actual knowledge is required to be certain. The accompanying figures were tabulated from data presented in a loose-leaf book being distributed by the Irvington Varnish & Insulator Co., Irvington,

TABLE SHOWING DIELECTRIC AND TENSIL STRENGTH OF VARIOUS TYPES OF INSULATING MATERIALS.

Type of Insulations.	Thickness in ins.	Dielectric strength in volts per mil.	Tensil strength in. lbs.
Yellow varnished cambric	0.007	800 to 925	45 to 55
	0.010	800 to 925	50 to 55
	0.012	800 to 925	50 to 55
Yellow varnished canvas	0.030	600 to 800	150
Black varnished cambric	0.007	900 to 1100	45 to 55
	0.010	900 to 1100	50 to 55
	0.012	900 to 1100	50 to 55
Yellow varnished paper	0.001	1000 to 1250	.....
	0.003	1000 to 1250	.....
	0.005	850 to 1000	.....
	0.020	.....	.....
Black varnished paper	0.007	850 to 1000	.....
	0.020	850 to 1000	.....
Yellow varnished silk	0.005	1000 to 1200	.....
Slot insulation to	0.012 to 0.030	500 to 700	.....

N. J. Proper factors of safety and similar allowances must be made in applying the data in any given case, but in any event the basic figures are essential to a knowledge of just what is required. The book from which this data was taken contains many other facts and figures of value to anyone interested in insulation.

Due to the impetus given to the fishing industry in South Africa by the Union government's recent survey of the coast grounds, there is a growing market for motors for boats. The strongest demand appears to be for those of 3.5, 7 and up to 15 hp., with a limited demand for the 60-hp.

OPERATION OF POWER AND LIGHTING SUBSTATION IN EMERGENCY.

The effectiveness of automatic substations for light and power service was shown recently when trouble occurred on the system of the St. Paul Gas Light Co. There was trouble on one of the trunk lines, which caused a momentary drop in voltage. The line was not cleared immediately, and all of the synchronous apparatus at the manual station was put out of service. The Westinghouse automatic substation, of course, cleared itself from the line, but was restored automatically to service in a few seconds. It helped to take care of the d-c. network, which was immediately picked up automatically by a storage battery at the manual station. The voltage on the d-c. system dropped from 240 to 180 volts. The contactors on the line panel of the automatic substation opened cutting in resistance. This station continued giving service, however, through this resistance until enough of the manual station equipment was brought back into operation to restore service to normal, the period of trouble lasting for about 5 min.

The automatic substation installed on the system of the St. Paul Gas Light Co. is the first automatic substation ever applied for use in light and power work. The substation was placed in operation some months ago, and the result has been entirely satisfactory.

HYDROELECTRIC CANAL AT NIAGARA NEARING COMPLETION.

The Niagara Falls (Ont.) hydroelectric canal is and has been making rapid progress toward completion. This great public work has been especially favored by the weather, which made it possible for the work to go on unimpeded during the past winter. Of 13,500,000 cu. yds. of earth excavation, 12,500,000 cu. yds. have already been removed; while of the 4,000,000 cu. yds. of stone excavation, 2,500,000 have been taken out. This speed in the removal of earth and stone has been accomplished by shovels which excavate 8500 cu. yds. of earth or 3000 cu. yds. of stone in 20 hrs. with two shifts of men. These shovels handle 8 cu. yds. of earth or 6 cu. yds. of stone at a time. The deepest cut in the canal is 135 feet. At the present rate of progress the earth excavation will be finished by July next and the stone excavation by August. The excavation of earth and stone is now ahead of schedule with good signs that it will continue so.

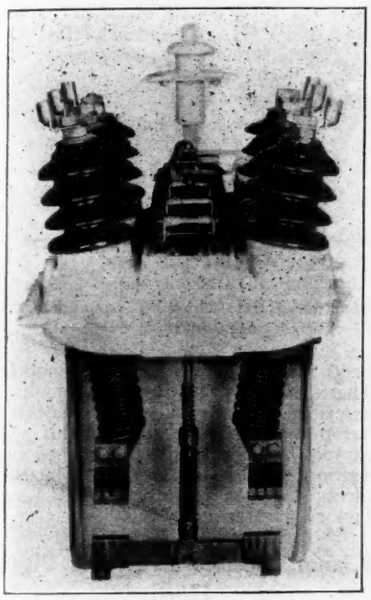
There are 280,000 cu. yds. of concrete work in the walls of the canal, while in the power house, screen house, intake. and control works there are 145,000 cu. yds., making a total of 425,000 cu. yds. of concrete work. Three turbines of 52,500 hp. have already been installed; generator No. 1 is well on the way to completion, and generator No. 2 is set in place, but not yet wound. By Jan. 1, 1922, there will be in operation 100,000 hp. There are now, and have been during the past winter, 7200 men working on this job. To house the workmen it has been necessary for the Hydroelectric Canal Commission to construct many buildings, as it has been impossible to get adequate housing accommodations in the city of Niagara Falls, Ont.

APPLIANCES and DEVELOPMENTS

New, Improved or Interesting Electrical and Mechanical Apparatus and Devices, and Applications of Equipment and Methods in Practice

New Type of Outdoor Oil Circuit-Breaker.

The General Electric Co. has recently developed the FKO-37 outdoor, pole-mounted type of oil circuit-breaker. The breaker is of standard unit construction, the blades, tanks, and contacts comprising each phase unit, or section, being not only interchangeable with those of any other phase, but with some parts of



Oil Circuit-Breaker for Pole Mounting.

the standard unit type FK-32A breaker of the same capacity. At present the FKO-37 breaker is made in but one capacity, 400 amperes, 15,000 volts.

The breaker is manually operated with either "remote" or "direct" control. In the former case a vertical pipe is connected from the breaker mechanism at the top of the pole to the operating lever located near the ground. In the latter case the breaker is so constructed that it may be operated by means of a removable operating lever. The remotely controlled breaker is closed by raising and throwing the operating lever to the right, the effort being transmitted through the operating mechanism to close the contacts. The tripping is accomplished automatically by means of overload trip coils connected to the secondaries of bushing transformers or external instrument transformers.

The new breaker embodies many desirable features. The bushings, with lines connected at the top, extend below the oil level. The construction is such that the possibility of breakdowns resulting from abnormally high voltage is minimized. A semaphore located on the forepart of the breaker indicates when the breaker has been tripped. The remote control mechanism for ground operation has provision for locking the breaker closed or opened.

The breaker is compactly constructed, and is sufficiently light in weight to be mounted either on one, or between two adjacent poles. When mounted on a single pole, angle iron braces are used to support the end of the breaker farthest removed from the pole. When mounted between two poles, these irons are not required, because the channel irons of the frame extend from one pole to the other. The breaker complete with oil, channel irons mechanisms, bases and cranks, weighs approximately 730 lbs.

Concrete Bases for Pole-Line Reinforcement.

The Harding process for concreting will become a utility necessity, according to the Geo. C. Eggers Co., Spokane, Wash., who are pushing its adoption. It meets the approval of the engineer, is based upon strictly scientific principles and is now in successful practical use. It is easy to install and is safe, and after erection, shows up neat, uniform, substantial—meaning higher valuations to line construction. It eliminates possible damage suits resulting from fallen poles. Old poles—poles with rotten, decayed ground lines—poles that have given years of service—may remain unmoved. The Harding process may be applied, resulting in a concrete base so applied, as to stay put.

The process is described as a concrete base that is easy to erect so as to make it a part of the pole; a concrete base that will not check or crack; a concrete base that will give from 20 to 50 years' added life to poles now ready for replacement; a concrete base that is affixed without interruption of service; a concrete base with such great resisting powers that at no time will the base show signs of breaking, even in strength tests; a concrete base the process of which allows of no air or moisture to enter between the pole itself and the concrete sleeve; a concrete

Base Installed on Transmission Line Pole.

Pole Base Installed Where Pole Extended Through Cement Walk.

base that may be applied at any hour of the day—any day—no waiting for arrival of new poles for replacements; a concrete base that may be used exclusively for untreated poles, for poles so far decay that replacements appear necessary; a concrete base, the cost of which may be considered as a "betterment" rather than a charge to "maintenance."

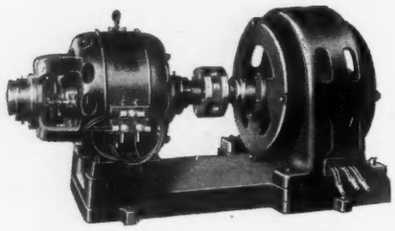
J. B. Fisken, in commenting on this process before a meeting of the National Electric Light Association last year, said in part: "The Harding process isn't strictly a reinforcement. It consists of casting a reinforced concrete socket around the pole, and it don't make any difference whether the pole is completely rotted off at the ground line, or usually about a foot below the surface of the ground. The pole can be maintained in service. * * * With the Harding process you can—and we do—cast a concrete socket around the pole. Now, with the present cost of poles and the labor cost of equipping a pole it is very important that we should be able to maintain the existing poles, and it can be done. You will see both processes right here in Spokane, and if you look out of the windows as you go between Post Falls and Coeur d'Alene City

there are two or three places where this line is pretty close to the track, and you will be able to see it."

Mr. Fisken was speaking of a 10-mi. pole line operated by the Washington Water Power Co., for which he is consulting engineer.

Synchronous Motors of Improved Construction.

The Ideal Electric & Manufacturing Co., Mansfield, O., are now manufacturing synchronous machines in addition to their regular line of d-c. and a-c. power apparatus. Many new and special features have been worked out in the new Ideal synchronous motors. The results of past experience in this field together with the present need of a self-starting synchronous motor which will start and pull into step while carrying a heavy load, have been largely responsible for this development. Mechanically, these machines are built unusually rugged with well-planned ventilation and electrical characteristics that insure the highest efficiency without sacrificing material or going to high temperature limits.



Motor-Generator Set With High-Speed Synchronous Motor.

An entirely new feature is the squirrel-cage-winding construction combining simplicity with ruggedness, from an electrical standpoint the most desirable combination to give the best results for starting and pull-in torque with economical intake from the line. Briefly, the mechanical and electrical construction of this feature is as follows:

Tubing, either copper or brass, is used instead of solid bars. Obviously, the outer diameter may remain the same for all standard designs, which evidently is a very important feature in connection with standard manufacture as it eliminates the necessity of using various index dies for the pole punchings. The resistance, however, of the tubular conductor may be varied over a wide range by changing the wall thickness of the tubing. Inside of this tubing are embedded conductors of magnetic material such as iron or steel. The bars are fastened to end-ring segments which also serve as upper coil supports for the field coils. These end-ring segments or upper coil supports forming a continuous ring are connected together between poles, using a split sleeve which fits into holes drilled on the job when the poles are assembled. A taper pin is driven in to secure contact and mechanical stability.

Rotor Construction of "Ideal" Synchronous Motor.

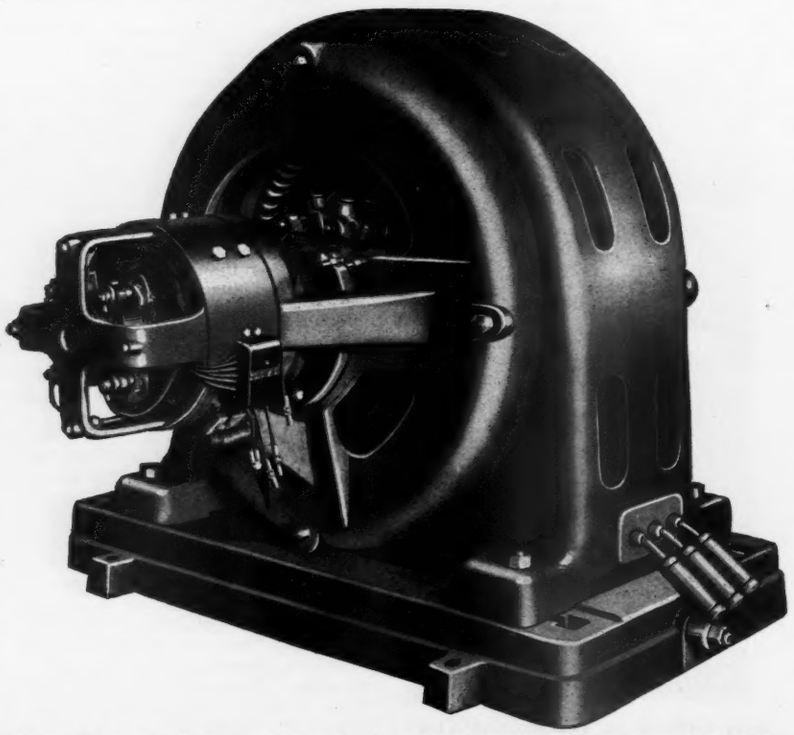
By using such a squirrel-cage winding it is possible to embody good starting torque without in any way injuring good pull-in characteristics. The electrical effect of this winding is as follows:

At starting the frequency in the squirrel-cage winding is the same as in the line, but as the rotor comes up to speed the frequency will fall off to zero. Due to the skin effect the inner bars of magnetic material will not be effective at starting, but a high starting torque is established by giving the copper or brass tubing the proper resistance. As the rotor is accelerating the inner conductors will become effective, and in the neighborhood of synchronous speed will furnish a high torque which, combined with a rather small torque at that speed furnished by the tubing, will give a high pull-in torque. In other words, it is possible with the use of such a squirrel-cage winding to make the torque characteristics adapt themselves to various applications of synchronous motors.

Another important feature is the collector-ring construction. In this construction no exposed revolving leads or wires are in evidence. The leads from the field coils to the collector rings are carried on the inside of the collector ring housing.

An inclosed brush holder of the grease-cup construction harmonizes in every way with the collector ring construction, thus giving the motor a distinct feature of safety and simplicity. These and other features are completely described in a new bulletin on synchronous motors just published by this company. To accommodate increased production the Ideal Electric & Manufacturing Co. has recently erected a new factory at Mansfield, O.

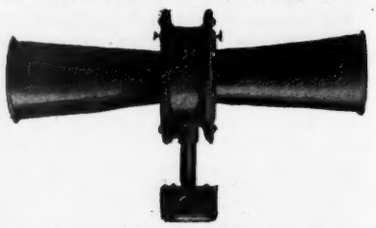
Assembled Pole Showing Various Details of Construction.



"Ideal" Standard High-Speed Synchronous Motor With Direct-Connected Exciter.

Klaxon Double Protector Signal Horn.

Under certain conditions in industrial factories or power plants it is desirable to have a signalling apparatus or horn which can be regulated in tone and also project the signal in two directions simultaneously, and to fulfill these requirements the Klaxon Co., Newark, N. J., has manufactured the Klaxon a.-c. duplex horn.



Klaxon A-C Duplex Horn.

This horn is a powerful vibrating type with two projectors pointing in opposite directions and provided with a thumb screw for regulating the tone or pitch of the sound issuing forth when the horn is operated. A lock nut holds in a fixed position the screw setting, but it may be changed readily when desired. The device is durably constructed and can be obtained for use on alternating current of all standard voltages.

ACTIVITIES IN THE TRADE

Business Developments, Sales Agencies, Trade Literature and Miscellaneous Items Concerning Electrical Manufacturers and Allied Business Interests

Wilson Wire Works, Devon Terrace, Kearny, N. J., has filed notice of increase in its capital stock from $10,000 to $50,000.

Standard Underground Cable Co., Pittsburgh, is planning the erection of a new plant at St. Louis. A site for the works is being selected.

Volk Electric & Manufacturing Co., 200 Fifth avenue, New York City, has filed notice of reorganization to operate with a capital of $25,000.

Electric Flasher Co., 80 Fifth avenue, New York City, manufacturer of electrical equipment, has filed notice of dissolution under state laws.

Electrical Testing Laboratories, Inc., East End avenue and 80th street, New York City, has filed notice of increase in its capital stock from $120,000 to $240,000.

The All-America Cables, Inc., New York City, has arranged for extensions and improvements in its building on Broad street, extending from Stone to South William streets, to cost about $300,000.

British-American Metals Co., Inc., manufacturer of copper tubing and specialist in seamless copper condenser tubes, has removed its New York sales offices from 52 Vanderbilt avenue to 200 Broadway. Its factory is located at Plainfield, N. J.

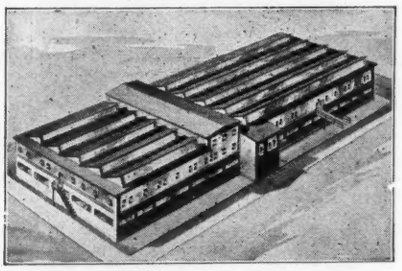
Thompson-Levering Co., 327 Arch street, Philadelphia, manufacturer of measuring instruments, has awarded a contract to the George Kessler Construction Co., Drexel building, for the construction of a plant on Westminster street, to cost about $50,000.

General Electric Co., Lynn, Mass., is now operating at about 75% of normal at its local plant, and it is said that incoming orders are sufficient to insure this capacity for some time to come. On April 1, the unfilled orders on the books of this plant totaled $10,000,000.

Manhattan Electrical Supply Co., Inc., 17 Park place, New York City, has announced a reduction in the prices on its "Red Seal" dry batteries, "Red Seal" sparkers and other dry cells, effective June 1. This action is simply carrying out the company's general policy of giving the trade the benefit of lower costs of raw material.

National Metal Molding Co., Pittsburgh, has issued a book illustrating and describing an advertising campaign which the company is undertaking to popularize its metal molding and the many advantages it makes possible. In commenting on the matter, I. J. Shulsinger, advertising manager, states: "This advertising effort is not simply designed to increase the sale of 'National' metal molding. We hope it will create interest in and a desire for more complete electrical service. We feel that the slogan we have adopted in connection with metal molding, 'Brings Electricity where Needed' will, in time, bring about a realization of the fact that electricity should be available wherever needed."

Rome Wire Co., manufacturer of copper rods, bare and tinned copper wire, stranded cables, rubber-covered, magnet and weatherproof wires, has announced that its new weatherproof wire mill is now completed and in operation at the plant in Rome, N. Y. The new plant is of concrete tile and steel construction, two stories, 125 by



New Weatherproof Wire Mill of Rome (N. Y.) Wire Co.

325 ft., and has a floor space of 81,250 sq. ft. It is well lighted and ventilated and protected by a sprinkler system. The company's engineers have spent several months in the work of designing special machinery so that high-grade weatherproof may be produced, uniform in quality and with a machine layout insuring every possible economy in labor cost.

Duparquet, Huot & Moneuse Co., 110 W. 22d street, New York City, at the recent New York Edison Co. electrical heating show displayed heavy duty kitchen electrical equipment consisting of a large range, baking oven, broiler, toaster and coffee urn. The apparatus was a good example of the type and kind of product turned out by this company.

National Carbon Co., Cleveland, has announced a reduction in the price of all standard types of "Columbia" dry batteries, effective June 1. An extensive newspaper advertising campaign is being conducted by the company to inform the public of the lower cost of these batteries, and the National Carbon Co. states that all "Columbia" dealers have also been supplied with a window poster announcing this fact.

Engineering Business Exchange, 30 Church street, New York City, has announced the opening of a Southeastern branch in the McLachlen building, Washington, D. C., with Marshall O. Leighton, consulting engineer, as director. Mr. Leighton graduated in 1896 from the Massachusetts Institute of Technology. He is a member of the American Society of Civil Engineers and the Cosmos and Chevy Chase Clubs in Washington. Associated with Mr. Leighton in carrying on the Exchange will be A. C. Oliphant, who was engaged in central station work and industrial engineering until he entered the Ordnance Department of the army during the war.

Pittsburgh Electric Furnace Corp., Pittsburgh, has established offices at 149 Broadway, New York City, in charge of Presley Hamilton.

Western Electric Co., 195 Broadway, New York City, has received a contract from the city authorities at Montevideo, Uruguay, South America, for the installation of a new telephone and telegraph system in the municipal limits to cost about $6,250,000.

Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., has issued a leaflet illustrating and describing its space heaters for commercial and domestic heating. The construction and distinctive features, as well as the application of these heaters, are given, together with over 100 specific uses.

Allis-Chalmers Manufacturing Co., Milwaukee, has re-elected the following officers: President, Otto H. Falk; vice-president and general attorney, Max W. Babb; secretary-treasurer, H. Woodland; comptroller, W. A. Thompson; assistant treasurer and secretary, R. Dill; assistant secretary, A. F. Rolf. The executive committee consists of Fred Vogel, Jr., Charles E. Albright, Charles F. Pfister, Otto H. Falk and Oliver C. Fuller.

Cutler-Hammer Manufacturing Co., Milwaukee, has published a 40-page book entitled "C-H Elevator Controllers." In addition to a description of the various C-H elevator controllers and accessories, the book contains a discussion of the types of motors best suited to elevator work and an outline of the usual method of selecting motors of the right horsepower and starting torque to insure satisfactory performance. Tables giving motor, fuse and wire ratings are also included. An index makes it easy to turn to any particular section of the book.

Electric Storage Battery Co., Philadelphia, has announced that a modern and completely equipped clubhouse and recreation grounds now nearing completion will shortly be turned over to its employes. This playground is located near Rising Sun and Adams avenues, Crescentville, Pa., on property owned by the company. The new structure and grounds are furnished with up-to-date equipment and include a baseball field, tennis courts, bowling alleys, shooting galleries, pool and billiard tables, gymnasium apparatus, shower baths, dining room, etc. An interesting feature of the company's gift is the provision that the employes themselves assume entire charge and responsibility for the clubhouse and grounds, including the cost of maintenance.

PERSONAL MENTION

Biographical Sketches and Chronicle of Changes in Business Connections, Promotions and Other Personal News of the Industry

HOWARD V. WOLFENDEN has joined the force of the New York bond department of H. M. Byllesby & Co.

J. L. HANSEN has established an office as consulting electrical engineer in the Utah Savings and Trust building, Salt Lake City.

A. H. ADAMS has resigned as chief engineer of the North Electric Manufacturing Co., Galion, O., and plans to locate in New York City.

E. E. HUDSON, who is well known in electrical and telegraph circles, has been elected president of the Waterbury (Conn.) Battery Co. to succeed the late Charles B. Schoenmehl.

CHARLES C. ALLEN, formerly with Dwight P. Robinson & Co., Inc., New York City, has become connected with the W. C. Hedrick Construction Co., Dallas, Tex., as vice-president of the company.

R. S. DANIELS has been appointed assistant to the chief engineer of the California-Oregon Power Co., San Francisco. He was formerly connected with the Washington Water Power Co., Spokane, Wash.

W. L. LAING, formerly with the Shepard Electric Crane & Hoist Co., Montour Falls, N. Y., has become connected with the Champion Engineering Co., Kenton, O., as superintendent of service and erection.

W. H. BLEECKER, JR., formerly district sales manager at the Chicago office of the Page Steel & Wire Co., has been transferred to the New York office in the same capacity. He has been succeeded in Chicago by E. J. Flood.

M. C. ERNSBERGER, professor of mechanical engineering at the University of Rochester, has been appointed professor of power engineering in the Sibley College of Mechanical Engineering at Cornell University, Ithaca, N. Y.

A. L. HADIN, at present chief engineer of railway power stations of the Commonwealth Edison Co., Chicago, has been appointed chief engineer of the embryo Calumet station. He will, however, retain his present title and duties for some time yet.

J. M. NELSON, who was recently elected assistant secretary of the Public Service Co. of Northern Illinois, Chicago, began work for the company in 1912, and 2 yrs. later was transferred to Oak Park, where after serving as district storekeeper he was placed in charge of credits and collections in that district. A year ago Mr. Nelson was transferred to the treasury department, Chicago, becoming in October, 1920, chief clerk, which place he held until elected to his present position.

WILLIAM H. MEADOWCROFT, Boonton, N. J., personal representative and confidential secretary of Thomas A. Edison, West Orange, N. J., has just celebrated his 40th year of association with the Edison enterprises. He was born in Manchester, Eng., and came to this country when 22 yrs. of age. His first connection with the Edison interests was in 1881, when he became assistant to the vice-president and general manager of the Edison Electric Light Co.

H. D. JAMES has been appointed manager of the industrial division of the Cincinnati district office of the Westinghouse Electric & Manufacturing Co. to succeed F. G. Kirkpatrick, who recently

H. D. James.

resigned. Mr. James graduated from the University of Cincinnati in 1906 and afterwards spent 5 yrs. with the Westinghouse company. In 1911 he left the Westinghouse company to become power engineer at the Union Gas & Electric Co. of Cincinnati. Mr. James served in the late world war and at the time of his re-entering the employ of the Westinghouse company he was with the Chace Engineering Co. of Cincinnati.

A. J. L'ECUYER has become connected with the Beardslee Chandelier Manufacturing Co., 216 South Jefferson street, Chicago. He has been actively engaged in the chandelier business since 1898, and has had a wide experience in selling, advertising and cataloging lighting equipment.

W. T. NEILL has been placed in charge of the rate department created jointly by the Pacific Power & Light Co. and the Portland Gas & Coke Co., Portland, Ore. He is an expert on questions of rates, valuations and other problems coming before public service commissions and his services should prove of value to the two companies in the new department of which he has charge.

COL. WASHINGTON A. ROEBLING, who has just turned 84 yrs. of age, was on June 7 elected president of the John A. Roebling's Sons Co., Trenton, N. J., manufacturer of wire rope, insulated wire and cable, etc., to succeed his nephew, Karl G. Roebling, who died recently. Colonel Roebling long has been identified with bridge construction projects. His earliest venture was the Pittsburgh suspension bridge across the Allegheny river. His most notable achievement, however, was the completion of the Brooklyn bridge, the entire construction of which devolved upon him after the death of his father in July, 1869.

MAJOR E. J. FOWLER, of Chicago, who was recently elected chairman of the Accounting Section of the National Electric Light Association, was the recipient of a further honor on June 9. Major Fowler is the statistician of the Commonwealth Edison Co. and the date named marked the 25th anniversary of his service with the company. Members and former members of the statistical department to the number of about 50 celebrated the event in Major Fowler's office, where he was presented with a large basket of flowers and also a gold watch suitably inscribed. The presentation speech was made by H. E. Niesz.

FREDERICK H. LEGGETT, who was recently appointed general manager of telephone distribution, in charge of telephone distributing houses, of the Western Electric Co., will soon celebrate his 23rd anniversary with the company. He started in its New York house after his graduation from Dartmouth in 1898 and stayed there for 4 yrs., going to Chicago in 1902 and later to Japan, where he acted as secretary of the Nippon Electric Co. In 1906 Mr. Leggett was appointed manager at Antwerp, foreign sales manager at New York in 1909, Pacific district manager in 1912, New York district manager in 1917 and Eastern district manager 3 yrs. ago.

OBITUARY.

WILLIAM F. O'NEILL, secretary and treasurer of the Penn Electric & Manufacturing Co., Irwin, Pa., died recently at the age of 54 yrs. He was born in Pittsburgh and had resided in Wilkinsburg, Pa., for many years.

JAMES P. SNEDDON, general superintendent of the Babcock & Wilcox Co. of New York and Chicago, manufacturer of water tube boilers, steam superheaters and chain grate stokers, died June 11 in New York City. He was 60 yrs. of age.

ISAAC SMITH, superintendent of tariffs of the Postal Telegraph-Cable Co., New York City, died last month at his home at Forest Hill, N. J. He was born in Brooklyn, N. Y., May 10, 1859, and became an operator for the Bankers & Merchants Telegraph Co. in 1880. In 1884 he entered the service of the Postal Telegraph-Cable Co., being connected with the auditor's and tariff departments until December, 1892, when he was appointed superintendent of tariffs, which position he held at the time of his death.

BUSINESS OPPORTUNITIES

News of Electrical Construction Projects in All Parts of the Country, Proposals Invited, Foreign Trade Openings and New Companies

EASTERN STATES

Bangor, Me.—The Bangor Railway & Electric Co. has acquired the plant and business of the Lincoln Light & Power Co., Lincoln, Me. Plans are under way for extensions in the plant and system. The Lincoln company was established about 5 yrs. ago by William C. Kirk, Detroit.

Rumford, Me.—The Rumford Pulp Products Co. will install electrically operated equipment, with motors, controlling apparatus, etc., at its new local plant for the manufacture of leatherboard specialties. An existing factory is being remodeled for the works.

Winthrop, Me.—The Bailey Oil Cloth Co. has filed plans for the erection of its proposed plant, to replace the works recently destroyed by fire. The work includes an electric power plant and considerable electrical equipment in the different manufacturing departments. The estimated cost is $250,000.

Brockton, Mass.—Electrical equipment will be installed in the 1 and 2 story factory to be erected on North Montello street by the Baker Realty Co., 103 Belmont street, estimated to cost $75,000.

Framingham, Mass.—Considerable electrical equipment will be installed in the addition to be erected at the paper specialty manufacturing plant of the Dennison Manufacturing Co., estimated to cost $75,000.

Bridgeport, Conn.—The Crane Co., South avenue, has awarded a contract to the T. J. Pardy Construction Co., 1481 Seavier avenue, for the erection of an addition to the power house at its local plant to cost about $125,000. Improvements will also be made in the present plant.

Hartford, Conn.—The Connecticut Light & Power Co. has filed notice with the State Department of intention to increase its capital from $15,000,000 to $25,000,000 for proposed expansion, operations, etc.

Batavia, N. Y.—The Genesee Light & Power Co. has made application to the Public Service Commission for permission to build an electric lighting plant to furnish service at Stafford and Attica. Franchises have been granted the company by the local authorities of these two places.

Binghamton, N. Y.—The Binghamton Street Railway Co. has made application to the Public Service Commission for permission to construct a new power plant at Endicott, N. Y.

Binghamton, N. Y.—The Achilles Rubber Co. has awarded a contract to S. B. Price, Emma street, for the erection of an addition to its power plant on Floral avenue, estimated to cost $23,000.

Brooklyn, N. Y.—The Brooklyn Edison Co., 360 Pearl street, has preliminary plans under way for the erection of its proposed generating plant on Marshall street, near the Brooklyn navy yard, estimated to cost $750,000. G. L. Knight is engineer.

Buffalo, N. Y.—The Niagara & Erie Power Co. is planning extensions in its transmission system at Depew, Lancaster, Hamburg, West Seneca and Cheektowaga. Transmission and distributing lines will also be extended at Dunkirk, Angola, Farnham, North Collins, Fredonia, Brant, Eden and vicinity. The entire project is estimated to cost $707,230, and capital stock for this amount will be issued.

Georgetown, N. Y.—The Georgetown Electric Lighting Co., Inc., has made application to the Public Service Commission at Albany, for permission to build and operate an electric lighting plant in Georgetown and the village. The company was incorporated in March, and with Charles D. Brown, Arthur A. Watson and Edward L. Andrus as directors, it plans to locate its plant at the Andrus feed mill where the company has made a contract with Mr. Andrus for power to run the generator.

Ithaca, N. Y.—The New York State Gas & Electric Corp. is planning the erection of an addition to its electric power plant at Plymouth, Chenango county, for extensions in its system at this point. Application for permission has been made to the Public Service Commission.

New York, N. Y.—The New York Edison Co. 130 East 15th street, has preliminary plans under way for extensions and improvements in its 2-story substation at 10-12 Elizabeth street. William Whitehall, 12 Elm street, is engineer.

Niagara Falls, N. Y.—Electrical equipment will be installed in the 2-story laundry to be erected on Main street by the Walker Laundry Co., estimated to cost $40,000.

Nyack, N. Y.—The Rockland Light & Power Co. plans an extension of its plant and generating facilities according to a petition filed with the Public Service Commission, asking permission to issue $500,000, 7% convertible bonds, to be sold for not less than 90, and to issue $500,000 in common stock for conversion purposes. The company plans the construction of new buildings, additional steam equipment, electrical and other miscellaneous equipment estimated to cost $435,000.

Wappinger Falls, N. Y.—The Wappinger Electric Corp. has been granted a local franchise for the operation of an electric light and power system. Application has been made to the Public Service Commission for approval.

Camden, N. J.—The board of directors of Cooper hospital is planning the rebuilding of the portion of the power house at the institution, recently destroyed by fire.

Newark, N. J.—The Department of Streets and Public Improvements is holding a series of conferences with the Public Service Electric Co., for improvements and extensions in the street-lighting system, as recommended in a recent report made for the city by Harry R. Jackson. It is proposed to replace the present arc lamps on Broad street with 1500-cp. tungsten lamps, with 1000-cp. lamps on Market street and other important thoroughfares. In other parts of the city 600-cp. lamps will be installed. Director Raymond is in charge.

Princeton, N. J.—The Borough Council is arranging for improvements in the street-lighting system in certain sections of the city, principally at the intersection of important thoroughfares.

Trenton, N. J.—The electrical department is considering plans for changes and improvements in its police and telegraph cable system, to eliminate the electrolysis conditions now prevailing. Negotiations are under way with the Delaware & Atlantic Telephone & Telegraph Co., and the Trenton & Mercer County Traction Corp. for necessary improvements for similar betterment.

Woodstown, N. J.—Electrical equipment will be installed in the 2-story cold storage plant addition to be constructed by the Woodstown Ice & Coal Co. William Richman is president.

Gettysburg, Pa.—Considerable electrical equipment will be installed in the local silk mill to be erected by J. H. & C. K. Eagle, Inc., Shamokin, Pa., estimated to cost $100,000 with machinery.

Harrisburg, Pa.—The Board of Public Grounds and Buildings has completed plans for the installation of a new street-lighting system in Capitol park. Bids will be taken at once.

Harrisburg, Pa.—Under the direction of the local chamber of commerce, Dr. William L. Robb, lighting expert, has made a survey of the local light and power system, and will make a report to the City Council for necessary improvements and extensions.

Hazleton, Pa.—The Pennsylvania Power & Light Co. will build a transmission line from its Hauto power plant in the Panther creek valley to Frankville, Tamaqua, Locust Valley, Morea and vicinity.

Hazleton, Pa.—The Wilkes-Barre & Hazleton Railway Co. is planning to close its power plant at St. John's at an early date. A contract for power supply has been made with the Pennsylvania Power & Light Co., which will make connection with the railway system at an early date.

Philadelphia, Pa.—The Department of Public Works has awarded con-

tracts to J. F. Buchanan & Co, 1715 Chestnut street, and Charles E. Tull, 117 North 16th street, for electric wiring, conduits, fixtures, etc., for police and fire stations in the city.

Philadelphia, Pa.—The Department of Public Works is having plans prepared for the erection of an addition to the electrically operated pumping plant for the city water supply at Lardner's Point. Improvements will also be made in the present pumping plant. C. E. Davis is director.

Wilkes-Barre, Pa.—The City Council has awarded a contract for furnishing electric service for street lighting to the Wilkes-Barre Co.

Baltimore, Md.—Considerable electrical equipment will be installed in the proposed local plant to be erected by the Carolina Chemical Co., Richmond, Va., estimated to cost $5,000,000 with machinery.

Baltimore, Md.—In connection with its proposed expansion and improvement program, with estimated investment of $560,000, the Chesapeake & Potomac Telephone Co., is arranging for certain features of the work to be placed under way immediately at a cost of about $112,000. Approximately $70,000 of this amount will be expended for the installation of new cables in the Hamilton and Boulevard exchange districts.

Chestertown, Md.—The Borough Council is perfecting plans for the purchase of the power plant and system of the Chestertown Light & Power Co., and the operation of the property under municipal ownership. The utility company has recently made application to the Public Service Commission for permission to increase the local light and power rates.

Washington, D. C.—The Potomac Electric Power Co. will expend about $250,000 for additions and improvements in its steam-operated generating plant at Benning, near Washington. Contracts for certain work have recently been let.

Lynchburg, Va.—The City Council is considering plans for the establishment of a municipal electric power plant.

Norfolk, Va.—The Board of Public Works has awarded a contract to the Smith-Hiller Co, 245 Bank street, for the installation of a new street-lighting system on Bank street, between Main and Queen streets.

Norfolk, Va.—The Automatic Light & Power Co. has been incorporated with a capital of $24,000 to operate a local light and power system. V. L. Cullen is president, and R. P. W. Baylor, secretary.

Charlotte, N. C.—The Southern Power Co. is planning additions in its power plant at Great Falls, S. C. and for extensions in its transmission system to cost about $1,000,000.

Hendersonville City, N. C.—The city will construct a lighting system on Main street. Address the mayor.

Shelby, N. C.—The Board of Aldermen is arranging for a bond issue of $50,000, to be used for extensions in the electric lighting system and municipal waterworks.

Elberton, Ga.—The Borough Council has approved a bond issue of $20,000 for extensions in the electric lighting system. The H. S. Jaudon Engineering Co., Elberton, will prepare plans. J. T. Dennis, Jr., is mayor.

Millville, Fla.—The City Council has arranged for a bond issue of $27,000 for the installation of a new electric lighting system.

NORTH CENTRAL STATES

Springfield, O—The residents of the Melrose district have presented a petition for electric lighting. Address B. J. Wescott, mayor.

Marshall, Mich.—The city will expend $80 000 for the erection of an electric light plant. Address P. S. Joy, commissioner.

Beech Grove, Ind.—The Indianapolis Light & Heat Co. has been granted a franchise for the installation and operation of a local electric street lighting system, at a price of $80.00 a year per lamp. The franchise has been approved by the Public Service Commission.

Evansville, Ind.—The Board of Directors of the Evansville college will build a power plant in connection with the erection of an administration building at the institution. The cost is estimated at $400,000.

Indianapolis, Ind.—A power house will be constructed by the Best Grand Laundry Co., in connection with the erection of its proposed mechanical laundry plant extensions and improvements, Senate and Court streets. The work is estimated to cost $100,000.

Indianapolis, Ind.—The Indiana Power Co. has made application to the Public Service Commission to issue bonds for $1,000,000, the proceeds to be used for operations, financing, extensions, etc.

New Castle, Ind.—The City Council made an appropriation of $30,000 to care for the expense of installing a new street lighting system and the rebuilding of the fire-alarm system. The money will be raised through a bond issue. Detailed plans and specifications for the new lighting and fire-alarm system were submitted to the council by Superintendent Luther Younce of the waterworks, and they call for the installation of a new 3-phase, 60-cycle, 2300-volt a-c belted generator, also for a new main switchboard with constant current regulating transformers. It is hoped to have the new equipment in operation September 1.

Marion, Ill.—J. W. Williams of East Main street will present a petition to the city commissioners requesting that the "white way" lighting system be extended from its present terminus on East Main street to the fair grounds.

Chicago, Ill.—Plans to make Lawrence avenue between Sheridan road and Broadway one of the brightest lighted sections of the Wilson avenue district were completed last week by C. C. Kennedy, of the real estate firm of Lawrence & Kennedy. Contracts have been signed for the installation of ornamental metal posts, topped with 500-watt tungsten lamps every 50 ft. on each side of the street. The cost will be about $4000, and the 12 property owners along the street have agreed to finance the project.

Chillicothe, Ill.—The business men and property owners have petitioned for ornamental lamps on Second street. The plans call for iron posts to be set eight to a block, four on each side of the street, one on each corner and two in the middle of the block. This will make a total of 40 posts or standards, each standard to carry four globes, which will make a total of 160 lamps. Address the mayor.

Ottawa, Ill.—At the playground Committee meeting, the question of lamps for the various parks and the necessity of installing a system of lighting for the central playground at King Field was reported on, showing that this item while expensive was very necessary and would be given careful attention. Address Chairman Christman, of the Playground Committee.

Quincy, Ill.—Engineer L. L. Harper, City Hall, has finished plans for the extension of the lighting system, estimated to cost $20,000. Address P. J. O'Brien, mayor.

Elsworth, Minn.—The council contemplates rebuilding the municipal lighting plant. Address the village clerk.

Davenport, Ia.—The City Commission is considering the installation of an electric lighting system to direct traffic in the downtown section of the city.

New Virginia, Ia.—The Holland & Davis electric light plant burned recently.

Preston, Ia.—The Rural Power Co. has been incorporated with a capital of $150,000. The incorporators are J. J. Marron, president, and F. M. Burts, secretary.

Booneville, Mo.—Electrical equipment will be installed in the 2-story plant to be erected by W. S. Mitchell, Booneville, for the manufacture of automobile tires.

Chillicothe, Mo.—Plans are under way for improving the municipal electric light plant. Address C. F. Adams, president of the Board of Public Works.

Fulton, Mo.—The Borough Council has plans under way for the construction of a municipal electric power plant to cost about $30,000.

Independence, Mo.—Bonds to the amount of $35,000 have been voted to improve the electric light plant. Address city clerk.

Jasper, Mo.—The Borough Council has commissioned A. C. Moore, engineer, Independence Building, Joplin, Mo., to prepare plans for the installation of a municipal electric lighting plant. A bond issue of $40,000 will be arranged to defray the cost of the installation.

Joplin, Mo.—The Empire District Electric Co. has been granted permission to issue $39,000 bonds for improvements to its system.

Springfield, Mo.—Possibilities of constructing a central power plant capable of supplying power for lighting, manufacturing and eventually an interurban electric line to connect

with Bolivar, Fair Play, Walnut Grove, Ash Grove, Everton, Phoenix, Greenfield, Lockwood and Golden City are being investigated by Elston, Axon & Russell, engineers of Springfield. Two propositions are under consideration; one is a waterpower project on the Sac river, north of Stockton, the other being a coal-power plant in the prospective coal fields of northern Dade county.

Unionville, Mo.—The Unionville Electric Light & Waterworks has completed plans for the construction of a municipal electric power plant to be operated in conjunction with a waterworks system, estimated to cost $85,000. Frank Stratton is in charge. The company was recently organized by the city.

Versailles, Mo.—The Versailles Flour Mill, Light & Power Co., has been organized to take over and operate the power plant of Henry Moser, who will be president of the new organization. Extensions and improvements will be made in the system.

Osborne, Kan.—The City Council has awarded a contract to the Busch-Sulzer Co., St. Louis, for the engine and generator to be installed in the new municipal light and power plant, at a cost of $49,800. The entire station is estimated to cost $75,000. E. T. Archer & Co., New England building, Kansas City, Mo., are the engineers.

North Platte, Neb.—The Chamber of Commerce is interested in a campaign which has started for a better lighting system. An electrolier system may be installed.

SOUTH CENTRAL STATES.

Bowling Green, Ky.—The Kentucky Public Service Co. is planning extensions in its power and distributing lines to Auburn and Woodburn, to cost about $30,000.

Salem, Ky.—The Salem Light & Power Co. contemplates expending $2000 on improvements. Address J. H. Mitchell, manager and engineer.

Martin, Tenn.—The Common Council has taken bids for the erection of a power plant and extensions in the municipal electric system to cost about $100,000. Bonds in this amount recently have been voted. The installation will comprise boilers, two generators direct connected to Corliss engines, pumps, switchboard and other auxiliary operating equipment. Frank L. Wilcox, Chemical building, St. Louis, is the engineer. George P. Hurt is mayor.

Oxford, Miss.—Electric light bonds to the amount of $15,000 will be issued by the city. Address Fletcher Hanks, commissioner.

Amorita, Okla.—The Borough Council is having plans prepared for the construction of a transmission line from Amorita to Kiowa, for local service. W. B. Rollins & Co., Railway Exchange building, Kansas City, Mo., are the engineers.

Comanche, Okla.—The Borough Council is arranging for a bond issue of $275,000 for the installation of a municipal electric plant and waterworks system.

Duncan, Okla.—At a special election, citizens have approved a bond issue of $300,000 for extensions and improvements in the municipal electric power plant and system. J. F. Elwell is city manager.

Durant, Okla.—The Consumers' Light & Power Co. is rebuilding its distributing systems at Durant and Madill. It has also recently installed a new 315-hp. boiler and a 75-ton ice plant in a fire-proof building, total improvements costing $180,000.

El Reno, Okla.—The Oklahoma Gas & Electric Co. plans expending $25,000 to rebuild its lines.

Hominy, Okla.—The Hominy Electric Light & Power Co. is installing a new 250-kw. generator and Westinghouse gas engine and is planning new street service in addition.

Jenks, Okla.—Street lamps are being installed here, and Bixby is also soon to have a complete street lighting system.

Paden, Okla.—The Common Council has arranged a bond issue for extensions and improvements in the municipal electric power plant.

Stillwater, Okla.—The Town Council has authorized the installation of additional equipment at the municipal electric power plant. G. E. Matkin is city clerk.

Yale, Okla.—The Common Council is considering plans for the installation of an ornamental street-lighting system in the business district.

Castroville, Tex.—An electric power plant will be constructed at the proposed local cement mill to be erected by the Gulf Portland Cement Co., 812 Gibbs building, San Antonio, Tex. The organization was formed recently with a capital of $3,000,000. W. S. Campbell is president and general manager.

Georgetown, Tex.—The Common Council will install new equipment at the municipal electric power plant to double the present capacity.

WESTERN STATES

Pe Ell, Wash.—Charles G. Johnson of Raymond, has purchased properties of the Central Light & Manufacturing Co. for a $7600 plant at Pe Ell.

San Francisco, Cal.—The California-Oregon Power Co. has applied to the Federal Power Commission for a preliminary permit to construct one or two dams and power plants in the Klamath river, in Klamath county, Oregon, to be used as a public utility.

PROPOSALS.

Freeburg, Ill.—Sealed bids will be received at the office of the village clerk June 23 for furnishing material and labor and constructing improvements to the municipal electric light and power system. The equipment to be furnished and installed includes one 120 kv-a., direct connected, a-c. generator with belted exciter; one 112.5 kv-a. belted a-c. generator and exciter; one 4-panel switchboard; one 10 kv-a. series street-lighting regulator; transformer, series street-lighting fixtures and lightning arresters; poles, line wires, guys, pins, insulators, etc. Plans and specifications may be seen at the office of the village clerk, Freeburg, Ill., or in the office of Fuller & Beard, engineers, Chemical building, St. Louis.

Washington, D. C.—Sealed proposals will be opened June 29 for the installation complete of an electric freight elevator in the U. S. Post Office at Wilmington, N. C., in accordance with the drawing and specification, copies of which may be had at the Supervising Architect's office, Washington, D. C.

INCORPORATIONS.

Newark, N. J.—Centrifugal Fan Co. Capital, 1000 shares of stock, nor par value. To manufacture electric fans. Incorporators: Gottlieb Yunker, Arthur E. Egner and A. W. Egner, Newark. Registered office, 9 Seventeenth avenue.

Brooklyn, N. Y.—Silent Motor Corp. Active capital, $110,000. To manufacture motors for talking machines and other service. Incorporators: C. A. O'Malley, L. H. Losee and J. P. Kelly.

New York, N. Y.—Kennedy & Hebgen, Inc. Capital, $10,000. To engage as electrical contractors. Incorporators: J. F. Kennedy, C. Nebgen and E. M. Grafton. Joseph & Seamans, 1834 Broadway, represent the company.

East Orange, N. J.—Melvin Electric Co., 14 Essex street, has filed notice of organization to manufacture electrical products. R. F. Melvin heads the company.

Newark, N. J.—Electrical Products Co., 187 Livingston street, has filed notice of organization to manufacture and deal in electrical products. George Cohan heads the company.

Wilmington, Del.—Electric Heating Corp. Capital, $300,000. To manufacture electric heating appliances. Local incorporators: T. L. Croteau, M. A. Bruce and S. E. Dill.

FOREIGN TRADE.

[Addresses of firms referred to in these trade opportunities may be obtained by writing to the Bureau of Foreign and Domestic Commerce, Washington, D. C., or its branch and local co-operative offices. Request for each opportunity should be on a separate sheet and the file number given.]

Electrical Heating Units (34,836)—A firm of machinery dealers in Ceylon desires to be placed in communication with manufacturers of electrical heating units, with a view to developing their use in drying tea.

Electric Welding Outfits (34,908).—A firm of ship repairers in France desires to purchase electric-welding outfits complete from motor to welders' gloves and face protectors. Quotations should be given f. o. b. New York City or c. i. f. French port. Cash to be paid. Correspondence should be in French.

Motor Engines (34,923)—Dealers in fishing boats in France desire to receive catalogs and prices of motor engines of from 5 to 25 hp. for fishing boats. The sizes of these crafts vary from 3 to 14 tons. The engine required is a single-cylinder, heavy motor, self-firing and not electrically fired. They must be of simple construction and easy to operate.

FINANCIAL NEWS

Comment on the Financial Outlook in the Electrical Industry, New Securities, Reports of Earnings, Dividends and Utility Stocks

Offering of Duquesne Light Co. Gold Bonds.

The Harris Trust and Savings Bank, Lee, Higginson & Co., and Ladenburg, Thalmann & Co., are offering an issue of $10,000,000 15-yr. 7.5% convertible gold debentures of the Duquesne Light Co., Pittsburgh, at a price of 98.5, yielding over 7.65%.

For the year ended Dec. 31, 1920, the Duquesne Light Co. reports net income after charges and taxes of $3,362,347, which compares with a surplus of $3,224,617 in the previous year. Income account for the year ended Dec. 31, 1920, compares as follows:

	12 mos. end. Dec. 31, '20.	12 mos. end. Dec. 31, '19.
Gross	$15,005,173	$11,917,566
Net after taxes	4,603,526	4,411,965
Other income	206,704	202,465
Total income	4,810,230	4,614,439
Net after charges, interest, etc.	3,362,347	3,224,617
Preferred dividends	410,133	446,398
Common dividends	1,458,080	1,488,080
Surplus	1,494,134	1,320,139

Stockholders Approve Sale of Preferred Stock.

Stockholders of the Northern Ohio Traction & Light Co., at the annual meeting, approved the refinancing plans involving the sale of $4,548,000 of preferred stock, bringing the capitalization of the company to $20,000,000, of equal portions common and preferred. The new stock will be offered to stockholders on either of the following plans: An exchange of two shares of the old 6% preferred for two of the new 7% by buying one share of the new at $95 and accrued interest, or an exchange of the old for the new by payment of $10 for each share so exchanged. In either case stockholders must agree not to sell their stock for less than $95 prior to Jan. 1, 1923. Stock not taken by stockholders will be offered to customers. Proceeds of the sale of the stock will be used for enlargements and improvements of the company's plants and equipments.

Power Company's Bonds Sold to Chicago Bankers.

The Columbus (O.) Railway Power & Light Co. has sold $3,000,000 3-yr. 8% sinking fund closed mortgage bonds to the Harris Trust and Savings Bank and Elston & Co., Chicago. The bonds are due June 1, 1924, and are being offered at 98 and interest, yielding more than 8.75%.

Illinois Utility to Issue Additional Stock.

The Western United Gas & Electric Co., Aurora, Ill., has been granted permission by the Illinois Public Utilities Commission to issue $5,000,000 additional preferred stock.

Appalachian Power Co.

	1921.	1920.
April gross	$ 179,039	$ 153,747
Net after taxes	89,482	76,302
Total income	90,649	76,302
Surplus after charges	8,088	7,919
Balance after preferred dividends	6,166	3,170
12 mo. gross	2,412,968	1,774,641
Net after taxes	1,066,706	823,166
Total income	1,072,540	823,166
Surplus after charges	133,016	19,938
Balance after preferred dividends	111,448	15,189

Note: Charges include depreciation reserve, amortization, discount and expense.

Detroit Edison Co. and Subsidiaries.

	1921.	1920.
April gross	$1,913,604	$1,488,113
Net earnings	493,261	213,869
Surplus after charges	212,555	32,768
4 mo. gross	8,144,294	7,031,277
Net earnings	2,265,869	1,647,601
Surplus after charges	1,187,973	953,354

Commonwealth Power, Railway & Light Co. and Subsidiaries.

	1921.	1920.
April gross	$2,633,689	$2,514,982
Net after taxes	885,862	823,958
Surplus after fixed charges	269,936	238,738
Balance after preferred dividends	180,171	148,973
12 mo. gross	31,874,975	27,833,724
Net after taxes	9,151,110	9,294,471
Surplus after fixed charges	1,931,257	2,670,967
Balance after preferred dividends	854,077	1,593,787

United Light & Railways Co.

For the year ended Dec. 31, 1920, the United Light & Railways Co. and subsidiary companies report surplus, after taxes, interest and other charges, of $1,423,786. Consolidated profit and loss account for the year ended Dec. 31, 1920, shows as follows:

Gross earnings	$12,296,206
Operating expenses, taxes, etc.	8,681,265
Net earnings	3,614,941
Interest, subsidiary dividends, etc.	2,191,155
Surplus	1,423,786
Preferred dividends	607,702
Balance	816,084
Profit and loss surplus	297,307

Consumers' Power Co.

The annual report of the Consumers' Power Co. for the year ended Dec. 31, 1920, shows consolidated gross earnings of $14,157,453, as compared with $11,439,094 in the preceding year. Net after taxes amounted to $4,321,772, against $4,222,049, while surplus after interest and charges, but before depreciation, was $2,208,812, compared with $2,533,217 in 1919.

Adirondack Power & Light Co.

	1921.	1920.
April gross	$ 374,371	$ 369,234
Net after taxes	156,401	156,532
Surplus after charges	83,275	102,666
12 mo. gross	4,800,588	4,077,756
Net after taxes	1,416,341	1,356,926
Surplus after charges	582,333	754,988

Utah Power & Light Co. and Western Colorado Power Co.

	1921.	1920.
April gross	$ 524,350	$ 531,390
Net after taxes	238,009	253,040
Total income	248,633	263,948
Surplus after charges	105,621	123,734
12 mo. gross	6,801,563	5,997,412
Net after taxes	3,158,975	2,860,387
Total income	3,308,009	2,982,399
Surplus after charges	1,586,877	1,323,866
Balance after preferred dividends	995,377	737,003

Philadelphia Co.

For the year ended Dec. 31, 1920, gross was $16,566,669, increase $2,792,168; net after taxes and depreciation $6,658,512, increase $600,153; total income $8,939,018, increase $10,619; fixed charges, etc., $3,524,054, decrease $808,259; preferred dividends $776,164, decrease $238,921; common dividends $2,576,364, decrease $70; surplus for year $2,062,436, increase $1,857,890.

Utah Securities Corp. Subsidiaries.

	1921.	1920.
April gross	$ 685,919	$ 683,275
Net earnings	314,045	338,241
12 mo. gross	8,715,696	7,740,272
Net earnings	4,078,950	3,864,225

Dividends.

	Term.	Rate.	Payable.
Allis-Chalmers, com.	Q	$1	Aug. 16
Allis-Chalmers, pfd.	Q	$1.75	July 15
Buffalo Gen. E. Co., com.	Q	2%	June 30
Elec. Stor. Bat., com.	Q	$3	July 1
Elec. Stor. Bat., pfd.	Q	$3	July 1
Manhattan El. Sup., com.	Q	$1	July 1
Mfrs. Lt. & Ht.	Q	2%	July 15
Manila El. R. R. & Lt.	Q	$1.50	July 1
Niagara Falls Pr., com.	Q	$1.50	June 15
Niagara Falls Pr., pfd.	Q	$1.75	July 15
Nor. Ohio T. L., pfd.	Q	1.5%	July 1
Okla. G. & El. pfd.	Q	1.75%	June 15
Shawinigan Water Pr.	Q	1.75%	July 11
Un. Lt. & Rys., 1st pfd.	Q	1.5%	July 1
Un. Gas Impvt., com.	Q	$0.50	July 15
Un. Gas Impvt., pfd.	Q	1.75%	Sept. 15
Westing. E. & Mfg., com.	Q	2%	July 30
Westing. E. & Mfg., pfd.	Q	2%	July 15

WEEKLY COMPARISON OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeller & Co., Rookery Bldg., Chicago.

Public Utilities.	Div. rate. Per cent.	Bid June 6.	Bid June 13.
Adirondack Electric Power of Glenns Falls, common	6	10½	10
Adirondack Electric Power of Glenns Falls, preferred	6	73	72
American Gas & Electric of New York, common	..	101	101
American Gas & Electric of New York, preferred	6	38½	38
American Light & Traction of New York, common	..	81	81
American Light & Traction of New York, preferred	6	80	79
American Power & Light of New York, common	4	57	58
American Power & Light of New York, preferred	6	71	72
American Public Utilities of Grand Rapids, common	..	7	7
American Public Utilities of Grand Rapids, preferred	7	18	18
American Telephone & Telegraph of New York	..	105	104
American Water Works & Elec. of New York, common	..	4	4½
American Water Works & Elec. of New York, particip	7	7½	8
American Water Works & Elec. of New York, 1st preferred	..	48½	49
Appalachian Power, common	..	3	4
Appalachian Power, preferred	7	30	29
Cities Service of New York, common	+extra	225	124
Cities Service of New York, preferred	6	65	40
Commonwealth Edison of Chicago	8	109	107
Comm. Power, Railway & Light of Jackson, common	..	10	10
Comm. Power, Railway & Light of Jackson, preferred	6	30	30
Federal Light & Traction of New York, common	..	6	6
Federal Light & Traction of New York, preferred	..	42	42
Northern States Power of Chicago, common	..	47	47
Northern States Power of Chicago, preferred	ex.div.7	80	80
Pacific Gas & Electric of San Francisco, common	..	47	49
Public Service of Northern Illinois, Chicago, common	7	80	80
Public Service of Northern Illinois, Chicago, preferred	6	81	80
Standard Gas & Electric of Chicago, common	..	11	10
Standard Gas & Electric of Chicago, preferred	8	34	33½
Tennessee Railway, Light & Power of Chattanooga, common	..	1	1
Tennessee Railway, Light & Power of Chattanooga, preferred	6	6	5
Western Power of San Francisco, common	..	28	27
Western Union Telegraph of New York	..	87	88
Industrials—			
General Electric of Schenectady	8	136	126
Westinghouse Electric & Mfg. of Pittsburgh, common	7	46	45